Knowledge Alliance in Air Transport

Report on Qualifications in Air Transport

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List of abbreviations

ATPL(A)	Airline Transport Pilot License (Airplane)
CAA	Romanian Civil Aeronautical Authority
CEDEFOP	European Centre for the Development of Vocational Training
CNCP	Commission nationale de la certification professionnelle [National Commission of Professional Certification]
CPL(A)	Commercial Pilot License (Airplane)
EASA	European Aviation Safety Agency
EC	European Commission
ECTS	European Credit Transfer and Accumulation System
ECVET	European Credit System for Vocational Education and Training
ENATE	Establishment of European Network for Aviation Training and Education
ENIC-NARIC	European Network of Information Centres - National Academic Recognition Information Centre
EQF	European Qualifications Framework
ESCO	European Skills, Competences, Qualifications and Occupations
EUA	European University Association
FTK	Freight Tonne Kilometre
HE	Higher Education
ICAO	International Civil Aviation Organization
ICT	Information and Communication Technology
IHLG	Industry High Level Group
IR(A)	Instrumental Rating (Airplane)
JOC	Jet Orientation Course
LCC	Low Cost Carriers
MCC	Multi Crew Cooperation
MTK	Mail Tonne Kilometre
NGAP	Next Generation of Aviation Professionals
NQF	National Qualifications Framework
PPL(A)	Pilot Private License (Airplane)
QF	Qualification Framework
RPK	Revenue Passenger Flight
SEP(L)	Single Engine Piston (Land)
SQF	Sectorial Qualifications Framework
SQFAT	Structure of the Sectorial Qualification Framework for the Air Transport
VET	Vocational Education and training
VFR	Visual Flight Rating

Executive Summary

This Report is a part of the research conducted on occupations and qualifications in air transport under the Erasmus+ project “Knowledge Alliance in Air Transport” (KAAT) with 28 partners from 11 countries under the coordination of University POLITEHNICA of Bucharest.

The main objectives of this report refer to presenting the background of the evolution of the air transport industry; identify the main trends in the evolution of labour contexts in the air transport industry in order to establish a methodology for describing qualifications in air transport in accordance with Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and with the requirements of International Civil Aviation Organization (ICAO) and European Aviation Safety Agency (EASA). Moreover, the report aims to identify and describe 30 qualifications relevant to air transport; identify and describe new qualifications necessary to meet the development trends of the air transport industry; present the information and communication technology practices for guidance and career development in air transport and for knowing the possibilities of qualification and finally clarify the relationship between occupations, skills/competences and qualifications.

In order to create a proper context for our analysis, we first look at the overview of aviation from the past to the future with an analyse of new needs in terms of human resources and qualifications necessary for sustaining the development of aviation moving toward the horizon of the year 2034. The evolution of air traffic and connectivity are presented with their implications on education and training in air transport. Moreover, the chapter focuses on digitalization and greenisation and their consequences on employees’ competences.

Following on the ideas of the greening of airports, the report rings some clarifications regarding the concept of societal responsibility in the context of air transport and follows with a brief analysis of the necessary competences of people involved in the actions generated by this type of responsibility.

Additionally, the links between the labour market and education and training in air transport are highlighted in the context of the past 16-years evolutions of the jobs and employers. Additionally, there are also presented the EC regulations on QF and the role of Knowledge Alliance in Air Transport (KAAT) project in the link between this regulations and air transport labour market demand, qualifications. This sets to grounds or the description of the emerging smart occupations followed by the listing of the new skills necessary for new smart qualifications demanded by the evolution of air transport. A special focused is placed on the skills and qualifications for digitalization and greenisation of air transport. We propose new qualifications that will be described in term of learning outcomes in Chapter nine.

The regulations on European Qualifications Framework (EQF) and a short presentation of the implementation on National Qualifications Frameworks (NQFs) in the countries involved in the KAAT project are presented as to identify possible convergences and bridges between the Vocational Education and training (VET) and Higher Education (HE) pathways.

A section is dedicated to the importance of the qualifications and the corresponding competences for undertaken the tasks in aviation as to identify the mismatch between competences and qualifications and their impact on accidents and incidents.

After clarifying the goals concerning the qualification policy in air transport for long term, several platforms representing the information and communication technology (ICT) practices for guidance and career development in air transport and for knowing the possibilities of qualification are presented. These platforms have been developed for implementation of European Commission policy for labour market.

The major contribution of this report is represented by the methodology that allows for the description of qualification in terms of learning outcomes taking in consideration the 2017 Council Recommendation on the European Qualifications Framework for lifelong learning. Further the definitions for key words for qualification framework are presented.

Based on the methodology the report describes 30 qualifications using learning outcomes: knowledge, skills, autonomy and responsibility and social and personal development. The qualifications are from level four, five and six accordingly to EQF.

A comparative analysis of qualifications Frameworks is presented in chapter ten where the approaches used in Air Traffic Control and National Qualification Frameworks are compared.

The new digital technologies applied in aviation will require the evolution of current jobs descriptions and underlying skills and competences but also for the description of new occupations. Some transversal skills and soft skills allowing to evolve in this new digital world become crucial. More than 95% of job offers in the aviation digitalization mention as part of required profile skills that do not fall under technical know-how or knowledge. These skills may be soft skills as creativity, autonomy or transversal skills as management, mastery of foreign languages.

General context of employment: a strong growth in recruitment needs and a lack of competent profiles

1. *The confirmation of increasing recruitment needs on all the functions in air transport*
   - Recruitment increases significantly for most companies in the air transport sector, both for prime contractors and subcontractors.
   - Recruitment increased significantly in 2017 with prospects until 2030.
   - Recruitment growth, however, is less than growth in turnover due to work to improve organizations and therefore productivity.
   - Recruitment covers all functions, but with a preponderance, in general, on the category “other jobs on airports”.
2. *We have identified skills shortages*
   - Companies report strong difficulties in finding qualified professionals with experience in the air transport industry, a criterion that seems particularly important in aeronautics compared to industries, including other transportation activities (naval, rail, automobile).

- In addition, the lack of attractiveness of the technical and even scientific study programmes and of industrial sectors accentuates recruitment tensions.
- Thus, many companies are unable to meet their recruitment needs: recruitment times are particularly long, up to a year to find the right profile and thus, companies ask their teams to increase the number of working hours.
- For example, the main difficulties are reported for professions which require more than one specialisation: software aeronautical architect, computational engineer with aeronautical knowledge, environmental air transport engineer etc.
- There are also classical occupations in aviation for which it is difficult to find people with the adequate qualifications; as for example mechanic for aircraft maintenance and for airline pilots.
- Some companies from air transport industry (Zodiac, Safran, Tiger Aero) have opened new trainings for covering the shortage of qualifications.
- There are many jobs which required interdisciplinary competences and so interdisciplinary qualifications; for this kind of jobs there are not enough study programs, in general for interdisciplinary competences as for example: IT & aviation, economics & aviation, environment & aviation, law & aviation.
- Taking in consideration new jobs, new knowledge and skills must be ensured appropriate curricula and furthermore curricula need to undergo chances on the new aviation work market.

3. *Recruitment levels on most occupations tend to change*
   - The degree levels required for aviation occupations tended to increase, more occupations are regulated or require new skills and knowledge.
   - The increase in the technical nature of the air transport operations will also have an impact on recruitment levels, and thus increase the share of engineers and managers.
   - The changes in the technical nature and approaches in the air transport operations will also have an impact on nature of skills and knowledge; new knowledge and skills are required as for example digital skills, renewable energies, environmental protection etc.
4. *An age pyramid that could in future greatly increase recruitment tensions*
   - Aviation, in general, is characterized by a significant proportion of older workers, as well as a share of young people that has fallen sharply, due to a slowdown in the recruitment of young graduates.
   - As a result, this imbalance in the age pyramid will have to be covered when older workers retire. The catch-up phenomenon is going to be multiplied in size, because of the higher needs in recruiting young graduates.
5. *More than one out of two jobs will not be the same in ten years*. The aviation digitalization makes obsolete with a high speed the competences. In most situations, the qualifications have not evolved with the same rhythm needed by enterprises. Automatization and the digital interfaces have been multiplying (as presented in Chapter one), triggering the need of new digital skills however the applicants for the jobs or current employee

do not master them. For solving the current situation High institutions or aviation bodies have initiated new interdisciplinary study programs and on job trainings, as for example Japan Airlines (Chapter 7).

New skills for new occupations, the main challenge for education and training in aviation

Digital knowledge and skills are very required in aviation. CEDEFOP's European skills and jobs (ESJ) survey - The great divide: Digitalisation and digital skill gaps in the EU workforce [16] mentions that the future structural transformation of EU labour markets is tightly knit with a high demand for advanced digital skills. For example, the majority (52%) of adult EU employees stated that a moderate ICT level is required to carry out their job tasks and another 19% require a basic level.

Together, more than 71% EU employees need some fundamental level (i.e. basic or moderate) of digital skills to perform their jobs. About 14% need an advanced ICT level, in contrast to the 14% who stated that they need no ICT skills at all in their jobs. Sweden, Denmark and Ireland are the EU countries in which more than 80% of the adult workforce need at least a fundamental level of ICT skills to do their jobs, in contrast to Cyprus, Romania and Greece where the same holds for about six in 10 workers. Portugal, Bulgaria, Latvia and the Netherlands have the highest share of employees (over a fifth) reporting that their jobs do not need any ICT skills at all.

The checklist below provides a guide for improvement of aviation sectors where high and interdisciplinary qualifications of employees are essential. The implementation of this checklist will require a necessary increase in R&D and technological innovation skills, leadership and concerted, interdisciplinary competences and this requires coordinated actions from public authorities at all levels, together with aviation stakeholders, financial sectors, and international and regional organizations:

- Economic Development Planning – Mainstream the priorities of the aviation sector in States' economic development planning so that aviation can be used as an economic development driver; this requires simultaneously air transport, economic and management competences;
- Air Transport Regulatory Framework – Establish and apply good governance for air transport, i.e. the institutional, regulatory, and policy frameworks, in which air transport is designed, implemented and managed. This field requires simultaneously skills and knowledge in aeronautics, legislation and regulations for air transport;
- Aviation Infrastructure – Develop quality aviation infrastructure (including air navigation systems and airports) commensurate with the level of predicted traffic growth and based on ICAO's global plans; this requires competences in ICT, aviation and smart and green energy solutions.
- Resource Mobilization – Promote diversified funding and financing sources in partnership with States, international and regional organizations, the industry, as well as multi-lateral development banks and other financial institutions. For this field, economic, strategy and aviation knowledge and skills are necessary in the same time
- Safety and Security – Comply with ICAO's global standards and policies, as well as the industry standards to continue enhancing civil aviation safety and security. A strong need for skills related to the "air transport safety

process" allowing to design the safety management and review the organization as a whole ensuring safety and security in air transport.

- Environmental Protection – Reinforce efforts toward minimizing the environmental effects from civil aviation activities, especially the achievement of the aspirational goals of carbon neutral growth from 2020. This trend requires informed and engaged employees as crucial participants to advance sustainable air transport solutions.
- Societal responsibility means simultaneously knowledge and skills in society aviation and environment.

For all above mentioned trends, digitalisation is a cross sectorial action which requires advanced skills and competences in ICT and in aviation simultaneously. The new digital technologies applied in aviation ask for all jobs, knowledge of digital tools and skills for their used. Beyond the knowledge of digital tools, the aviation jobs will have to make a rise in skills. Furthermore, new occupations will appear. Some transversal skills and soft skills allowing to evolve in this new digital world become crucial. More than 95% of job offers in the aviation digitalization mention as part of required profile skills that do not fall under technical know-how or knowledge. These skills may be soft skills as creativity, autonomy or transversal skills as management, mastery of foreign languages.

The new skills fit in three major areas that will transform in aviation: technological transformations, organizational evolution and strategic evolutions in aviation.

The technological revolution in aviation presented in the report and the environmental constraints favour the emergence of new occupations which demand new skills and knowledge, these meaning new qualifications. Our survey on new occupations in air transport indicates that digital skills are crucial for innovation in air transport and for supporting the above-mentioned trend.

The evolution to future aviation, for example airport 4.0, generates the creation of new many jobs. We present some of them resulting from our analysis, which demand interdisciplinary skills and knowledge: Data Scientist, Airport UX Designer, Growth Hacker, Developer, Responsible for Societal Enterprise Responsibility, Wellbeing officer, Chief IoT project, he is in charge with the implementation of IoT on airport; Data architect; Responsible with digital data; Cybersecurity engineer; Robot technician; Mechatronic engineer; Responsible e-CRM (Customer Relationship Management); Virtualisation engineer and Responsible supply-chain.

The new main skills demanded by new occupations are both technological and non-technological. Technological skills, are: connectivity, IoT, network, interoperability, security of data, virtual reality, augmented reality, cobotics; while non – technological skills, are: knowledge management, sharing information, physic ergonomy and cognitive of equipment and infrastructures of aviation, autonomy and responsibility, initiatives and decision making, creativity, project management, system engineering, quality of life at work (wellbeing), social networks.

Interdisciplinary Master Programme: ICT Applied in Aviation

Nowadays, it is unthinkable to manage a sector as air transport without using ICT technologies. In this sector, we work with complex systems which need specialists who master both informatics and solid knowledge in aviation. The application of IT is crucial for process controlling, for optimization of activities or for the design of new procedures or prototypes, e.g.: ACDM, ATM, SMS, for “digitalization” of airports, for building Airport 4.0. Furthermore, Industrial programmes in Europe like SESAR based on IT deployment in air transport provide another reason to create a new international interdisciplinary Master programme to ensure simultaneously competences in aviation and in ICT.

Unfortunately, IT support of aviation poses a specific challenge: mixed teams of aero specialists and IT experts do not "speak the same language", i.e. they do not share a common expertise. To overcome this difficulty, this initiative envisioned a cross-sectorial master programme common for the two profiles. The innovative feature of the new cross-sectorial master or Bachelor programmes in air transport will consist in new modes of delivery, in particular the integration of a greater variety of study modes: distance, modular learning with adapted curricula, through new forms of personalized learning, strategic use of open educational resources, virtual mobility, European internships with the main air transport employers, blended mobility and virtual learning platforms. Delivery will include lecture, e-learning, on line courses and study cases, airport, airline or systems simulation, on-site visits to air transport and IT industry facilities, and projects completed with industry partners.

Part of the KAAT Project we will create a master programme combines profound worldwide experience in international projects and up-to-date ICT technologies and will be organized by modules in order to provide degree options to a wide population which includes the national and international air transportation and IT communities. Due to its modularity, it will allow access, on one hand, to air transport engineers who may choose modules mostly ICT modules and, on another hand, to ICT engineers who may choose modules on air transport. At the end of study programme, all graduates will have in-depth knowledge in applied ICT in air transport.

The master will ensure knowledge and skills for the following jobs: chief IoT project, data architect, responsible with digital data, cybersecurity engineer, virtualisation engineer.

The optimization and improvement of the overall aviation system generates substantial economic and environmental gains in the face of dramatic traffic growth projections and the pressing need for more determined and effective climate related stewardship. The continued demand for new technology nurtures the development of specialized parts manufacturing clusters worldwide. In turn, the growth of these clusters creates an increasing demand for highly-skilled technicians and designers from local communities. This improves the educational, career and wage prospects of residents, as well as their quality of life.

Introduction

This Report is a part of the research conducted on occupations and qualifications in air transport under the Erasmus+ project "Knowledge Alliance in Air Transport" (KAAT) with 28 partners from 11 countries under the coordination of University POLITEHNICA of Bucharest.

1. Objectives

The main objectives of this report are:

1. Present the development context of the air transport industry;
2. Identify the main trends in the evolution of labour contexts in the air transport industry;
3. Establish a methodology for describing qualifications in air transport in accordance with Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and [26] and with the requirements of Civil Aviation Organization (ICAO) and European Aviation Safety Agency (EASA);
4. Identify and describe 30 qualifications relevant to air transport;
5. Identify and describe new qualifications necessary to meet the development trends of the air transport industry;
6. Present the information and communication technology (ICT) practices for guidance and career development in air transport and for knowing the possibilities of qualification;
7. Clarify the relationship between occupations, skills/competences and qualifications.

2. Methodology of Work

The research method consists in: an analysis of European Commission (EC) and European Aviation Safety Agency (EASA) regulations in air transport, European Association University (EUA), European Centre for Development of Vocational Training (CEDEFOP) and International Civil Aviation Organization (ICAO) reports on qualifications frameworks (QFs) and occupations; a wide consultation with stakeholders; in situ analysis based on interviews with stakeholders and a survey on airports needs in terms of occupations, employee qualifications and skills for the future airport (the next 10 years). Furthermore, a methodology on a Sectoral Qualifications Framework (SQF) and recognition of prior learning and work experience in aviation is developed by a working group established in University Politehnica of Bucharest, in line with the European Qualification Framework (EQF) and European Skills, Competences, Qualifications and Occupations (ESCO) initiatives and with air transport regulations. The sources used are listed in the References sections while the bibliography is mentioned in Annex 1 - Useful links.

The methodology of the survey on the new occupations and competences/ skills were: to identify the airports' needs in terms of occupations, qualifications and skills of employees for the future airport (the next 10 years); to match the learning outcomes of study programmes with the demands of airport labour market in terms of competences; to improve the skills of the future generation of airport workers.

The questionnaire used for this survey was structured in five chapters containing 31 questions, as follows: Background and employment (Q1-Q8), Education and training (Q9-Q18), Collaboration with educational institutions and training providers (Q19 – Q23), Key competences (Q24 – Q28) and New and emerging occupations (Q29 – Q31).

This analysis aims to present links between occupation and qualifications, providing useful information on their nature. Particular attention is paid to the linkages between regulated professions and qualifications. The different categories of relationships will be presented.

The key concepts used in the report are: occupation, qualification, learning outcomes, knowledge, skills, autonomy and responsibility, and competence and they will briefly be defined below.

Occupation is defined as any activity in which a person is engaged.

Qualification refers to a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved some learning outcomes according to given standards [26]. Thus, the qualification is the formal acknowledgement of the value of the individual learning outcomes for the labour market, as well as for the continuing education and training, by means of a study document (diploma, certificate or attestation) awarding the legal right to practice a profession / trade.

Learning outcomes represent statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of three categories: knowledge, skills and responsibility and autonomy [26]. Thus, the learning outcomes are the set of knowledge, skills, attitudes (responsibility and autonomy) a person has acquired or is able to demonstrate upon completion of the learning process during a certain educational cycle.

Knowledge refers to the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the EQF knowledge is described as theoretical and / or factual [26].

Skill are the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the EQF skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments) [26]. Skills include certain types of operating structures, from dexterity to interpretation and problem-solving capacities.

Responsibility and autonomy are described as the ability of the learner to apply knowledge and skills autonomously and with responsibility.

Competence means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development.

3. Structure of the Report

The structure of the report consists in a presentation, in the first part, of the context of air transport development, of the regulations and implementation of European Qualifications Framework and of the trends in the policy of qualifications in air transport. In the second part, we present the methodology for description of qualifications and the description of 30 relevant qualifications in terms of learning outcomes accordingly to Council Recommendation of 22 May

2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 [26] on the establishment of the European Qualifications Framework for lifelong learning (2017/C 189/03). In the second part, the Report also presents the platforms for guidance and career development in aviation.

The report is organised around two main parts. Part one is giving a very generous description of the background of the aviation industry while part two is focused on the explaining the methodology used and the description of the 30 qualifications. To explain further, part one will present the trends in air transport development, the economic and social benefits of aviation and the impact on occupations and qualifications; an analysis of regulatory framework for qualifications in air transport; the policy in air transport qualifications and finally some ICT platforms for guidance and career development in the aviation and air transport. As mentioned before, part two explains the methodology for SQF used in the description of 30 relevant qualifications followed by the description of 30 qualifications using learning outcomes: knowledge, skills, autonomy and responsibility and social and personal development.

The report identifies and qualifies links between occupations and these qualifications and will underline any mismatch between the learning outcomes assured by qualifications (supply) and the occupations requirements (demands) in order to improve them (objective of WP 4 and also of WP6- ENATE after the lifetime of the project).

Following the introduction, chapter one presents an overview of aviation from the past to the future with an analyse of new needs in terms of human resources and qualifications necessary for sustaining the development of aviation moving toward the horizon of the year 2034. The evolution of air traffic and connectivity are presented with their implications on education and training in air transport. Moreover, the chapter focuses on digitalization and greenisation and their consequences on employees' competences. The economic and social benefits of aviation are also presented.

Chapter two brings some clarifications regarding the concept of societal responsibility in the context of air transport and follows with a brief analysis of the necessary competences of people involved in the actions generated by this type of responsibility.

Chapter three describes the links between the labour market and education and training in air transport. Moreover, it presents the evolutions of the last 16 years of the types of jobs and the types of employers. Additionally, there are also presented the EC regulations on QF and the role of Knowledge Alliance in Air Transport (KAAT) project in the link between this regulations and air transport labour market demand, qualifications.

Chapter four highlights the emergence of smart occupations that are due to a consequence of the development and evolution of the sectors presented in chapters one and two, followed by the listing of the new skills necessary for new smart qualifications demanded by the evolution of air transport. Especially, we present the skills and qualifications for digitalization and greenisation of air transport. We propose new qualifications that will be described in term of learning outcomes in Chapter nine.

In chapter five the European Commission (EC) regulations on EQF and a short presentation of the implementation on NQFs in the countries involved in KAAT project are presented. EC regulations in air transport qualifications are also presented in order to identify possible convergences and bridges between the Vocational Education and training (VET) and Higher Education (HE) pathways.

In chapter six the importance of the qualifications and the corresponding competences for undertaken the tasks in aviation are presented. Moreover, the mismatch between competences and qualifications and their impact on accidents and incidents.

Chapter seven, the Flightpath 2015 strategy is presented in order to identify the goals concerning the qualification policy in air transport for long term. Several platforms representing the ICT practices for guidance and career development in air transport and for knowing the possibilities of qualification are also presented. These platforms have been developed for implementation of EC policy for labour market.

Chapter eight achieves one of the main objectives of the report, that of detailing the methodology that allows for the description of qualification in terms of learning outcomes taking in consideration the Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning [26]. In this chapter you can find the definitions for key words for qualification framework.

Based on the methodology presented in the chapter eight, chapter nine describes 30 qualifications using learning outcomes: knowledge, skills, autonomy and responsibility and social and personal development. The qualifications are from level four, five and six accordingly to EQF.

A comparative analysis of qualifications Frameworks is presented in chapter ten where the approaches used in Air Traffic Control and National Qualification Frameworks are compared.

The last sections of the current report are dedicated to the conclusions, the reference list and then the annexes the authors considered relevant: useful links, legal framework, the questionnaire mentioned in section 4.3 and Bloom's verbs and matching assessment types.

4. Uses of the Report

This Report presents a state of the art on qualifications from air transport industry, including an analysis of 30 qualifications within the field. An important part of this work consists in clarifying the relationships between occupations, skills/ competences and qualifications.

The analysis on qualifications in aviation may be considered as "special" due to safety and security requirements and possibly the existence of environmental externalities. According to various economic studies, however, there is little or no evidence that aviation has unique economic and human resources characteristics, compared to other modes of transport and service industries. Nevertheless, most bilateral air services agreements still include the 70-year-old traditional provisions partially because there is a significant cost in each State to change the well-established regulatory framework. The key to addressing the dynamic and rapid transformations shaping the aviation sector is the establishment and application of good regulatory practices and, more broadly, good governance – the institutional, regulatory, and policy frameworks in which air transport is designed, implemented and managed. For example, States should comply with ICAO's global standards and policies; adhere to international air law instruments; separate their oversight functions from the operations of airports and air navigation services; enhance the transparency of relevant States' policies and practices; take a data-driven approach, including an assessment of the impacts and results of the regulation, etc.

The authors hope that this report could be useful to a various stakeholder such as higher education institutions that are looking to enrich their offer of education programmes, companies in the aviation and air transport industry that are looking to improve their internal training programmes, various educational platforms that offer information on training and education paths and many more. The authors wish you a pleasant reading experience and gladly await you feedback, questions or comments at the correspondence email address: sorin.zaharia@gmail.com

1 Aviation Overview: From Past To Future – Smart Air Transport; Economics and Social Benefits

The air transport industry includes those activities that are directly dependent on transporting people and goods by air. This includes:

- the aviation sector– airports, airlines, general aviation, air navigation service providers and those activities directly serving passengers or providing airfreight services; and
- the civil aerospace sector, which comprises the manufacture and maintenance of aircraft systems, frames and engines.

Together, these two sectors provide a measure of the total industry, which is termed “the air transport industry”.

This chapter briefly presents the dynamics of the air traffic, discuss the evolution of the price of air travel, the growth of the airport connectivity, digitalization and greening of airport.

1.1 Performance of Aviation

No other transport mode can provide such a worldwide mobility network as aviation does now. So, its role in supporting the global economic growth (including in developing areas) is unique, being essential for business and tourism. According to *Air Transport Action Group* (ATAG[1]) over 40% of the value of the interregional exports of goods is made by air, i.e. about $18 billion worth of merchandise daily. Kenya roses travel overnight to Amsterdam, French cheese is flown to Tokyo, Formula 1 are shipped by air between circuits in the championship. ATAG report [7] also shows 25% of all companies’ sales are dependent on air transport. 70% of businesses surveyed by ATAG report that serving a bigger market is a key benefit of using air services. 85% of the international business travellers travel by air.

And 54% of tourists travel by air, compared to 39% by road, 5% on water and 2% by rail. The increase in cross-border travel reflects improved relationships developing between countries, both at individual and at state level. In the same way, eased restrictions on the movement of goods and people across borders facilitate the development of social and economic networks that will have long-lasting effects.

E-commerce development was also stimulated by the reduced costs of air transportation. Some 87% of B2C (business-to-consumer) e-commerce parcels are currently carried by air. The e-commerce share of scheduled international mail tonne kilometres (MTKs) grew from 16% to 83% between 2010 and 2016 and is estimated to grow to 91% by 2025.

Social benefits of aviation. Aviation broadens people’s leisure and cultural experiences via wide choice/ affordable access to destinations across the globe and supports the improvement of living standards and alleviates poverty through tourism. As aviation often serves as the only means of transportation to remote areas promoting social inclusion while it also facilitates the delivery of emergency and humanitarian aid relief in cases of emergencies. Moreover, aviation contributes to sustainable development by: facilitating tourism and trade, generating economic growth, creating jobs, increasing tax revenues.

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[1] www.atag.org

Self-sustainability. Although aviation's socio-economic benefits and its multiple links to other economic sectors are widely recognized, this has rarely translated into the level of investment which is necessary to truly derive these benefits. Air transport received a 4.2% ($4.6 billion) of the total Official Development Assistance provided by all donors for economic infrastructure and services for the past decade. In comparison, road transport was allocated a share of 54.7%, which amounts to $60.9 billion [36].

Unlike other modes of transport, the aviation industry has been paying for a vast majority of its own infrastructure costs (runways, airport terminals, air traffic control), rather than being financed through taxation, public investment or subsidies. Infrastructure costs are covered through payments of user charges, most of which are added to airfares. In 2016, airlines and passengers were estimated to have paid $125.9 billion to airports and air navigation [38]. On the contrary, air transport is a large contributor to the public finances. In 2016, airlines and their customers were estimated to generate $117 billion in tax revenues, which is equivalent to 45% of the industry's gross value added (firm-level equivalent to GDP), paid to local, provincial and national authorities through passenger duties, domestic value-added tax, customs and immigration levies, etc [38].

Even in these terms, aviation is a good investment. Research conducted in the US suggests that every dollar invested in aerospace yields an extra 70 cents in GDP year after year.

1.1.1 Direct and Indirect Economic Impact of Aviation

Aviation Benefits 2017 [8] is a report published by *Industry High Level Group* (IHLG), an initiative of the *International Civil Aviation Organization* (ICAO) Secretary General, bringing together the Heads of four industry organizations: the *Airports Council International* (ACI), the *Civil Air Navigation Services Organisation* (CANSO), the *International Air Transport Association* (IATA) and the *International Coordinating Council of Aerospace Industries Associations* (ICCAIA). The report coming from such a prestigious and reliable source provides some impressive figures:

In 2016, airlines worldwide carried around 3.8 billion passengers annually with 7.1 trillion revenue passenger kilometres (RPKs). This is forecast to double by 2035 to over 14 trillion. 53 million tonnes of freight were transported by air, reaching 205 billion freight tonne kilometres (FTKs) [8, pg. 20]. Every day, around 100,000 flights transport over 10 million passengers.

Aviation's global economic impact (direct, indirect, induced and catalytic) is estimated at nearly $3 trillion, equivalent to 3.5% of world Gross Domestic Product (GDP) in 2014 [35]. Considering only the direct impact, the 9.9 million direct jobs in aviation added USD 664.4 billion (see figure 1.1) to the world GDP (representing 0.87%) [8, pg. 20]. If aviation were a country, its direct GDP would rank 21st in size (like Sweden or like Switzerland). Moreover, the jobs in this sector are on average 3.8 times more productive than other jobs. (By opening markets, enabling knowledge transfer and other catalytic effects, aviation also makes jobs in other sectors more productive.)

The forecast is that the global economic impact of aviation will double in 20 years to reach $6 trillion, while the number of jobs supported will increase to nearly 100 million.

Besides the unique worldwide network, the air transport is superior in efficiency to other competitor modes: aviation occupancy rates reach 78% (2017 industry load factor) which are better than those of road and rail. Modern aircraft achieve fuel efficiencies of 3.5 litters per passenger per 100 kilometres, better than car travel. This performance standards and the deregulation and liberalisation effects produced a spectacular decrease in the costs of air transport.

Aviation is also one of the most efficient sectors measured in terms of GDP per worker, around three and a half times the average across the world economy, exceeding most other sectors of the economy. Air transport employees are highly skilled, trained and experienced. This requires adequate qualifications assured by highest skilled teachers and trainers familiarized with new technologies of teaching (see Chapter eight).

The economic benefits of aviation extend much further than the industry's direct impacts. The indirect impacts include employment and economic activity generated by suppliers to the aviation industry: aviation fuel suppliers; construction companies that build airport facilities; suppliers of sub-components used in aircraft; manufacturers of goods sold in airport retail outlets; and a wide variety of activities in the business services sector (such as call centres, information technology and accountancy). Over 11 million indirect jobs are supported globally through the purchase of goods and services by companies in the aviation industry. These indirect jobs contributed approximately USD 638 billion to global economic activity in 2017 [7, pg. 14].

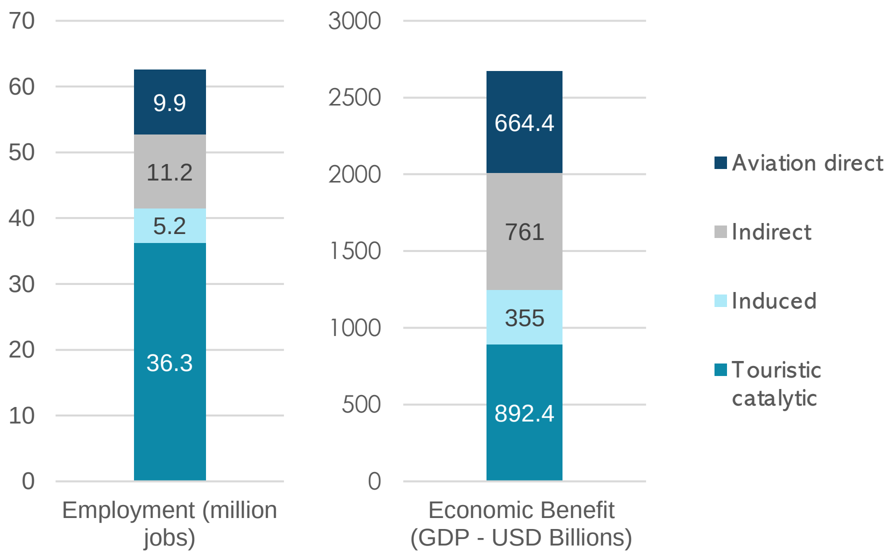

Figure 1.1 Aviation's global employment and GDP impact in 2014
Source: [8] page 9

1.1.2 The Catalytic Impact of Aviation

There is a clear distinction between direct, indirect and induced economic impacts of air transport and the 'catalytic' impacts. In simple terms, the economic value of the direct, indirect and induced effects is related to the total revenues of the air transport industry, whereas the catalytic impacts are "spin-off" effects on other industries. This is the air transport industry's most important economic contribution, through its impact on the performance of other industries and as a facilitator of their growth. It affects the performance of the world economy, improving the efficiency of other industries across the whole spectrum of economic activity – referred to as catalytic or "spin-off" benefits.

- Air transport facilitates world trade: air transport helps countries participate in the global market by increasing access to markets and allowing the globalisation of production. Given the facility of air transport, countries can specialise in activities in which they have a comparative advantage and then trade with countries producing other goods and services.
- Air transport is indispensable for tourism, particularly for island destinations or other remote locations. Tourism directly supports jobs in airlines and airports, and spending of visitors arriving by air supports the creation of a substantial number of jobs in the tourism industry.
- Air transport boosts productivity of the global economy by expanding the market in which companies can operate due to the improved transport links. As a result, companies are better able to exploit economies of scale thereby reducing costs, and to specialise in their areas of comparative advantage. By opening markets, air services expose companies to more competition, encouraging them to become more efficient.
- Air transport improves the efficiency of the supply chain, for example, many industries use air transport to shorten delivery times as part of their just-in-time delivery systems, enabling them to deliver products to clients quickly and reliably and to reduce costs.
- Air transport is an enabler of investment both into and out of countries and regions: viable air transport links are one of the key considerations that influence the location where international companies decide to invest. Air transport can act as a spur to innovation by encouraging effective networking and collaboration between companies located in different parts of the globe. A good transport infrastructure can also encourage greater spending on research and development by companies – for example, increasing the size of potential markets allows the fixed costs of innovation to be spread over larger sales.
- Air transport provides consumer welfare benefits to individuals in terms of the increased availability of travel connections, and for local airport communities. The welfare benefits should be considered in the context of environmental impacts on, for example, air quality, noise and congestion in the vicinity of airports.
- Swift delivery of medical supplies, organs for transplantation

1.2 Air Travel Affordability

A key driver in the growth of passenger traffic has been the steady decrease in the real cost of air travel. Since 1970, the real cost of air travel has been reduced by over 60%, through deregulation of the aviation market in the 1980s, the development of more fuel-efficient aerospace technologies and the introduction of low-cost carriers (Fig. 1.3). It is now more affordable for more of the population to travel by air.

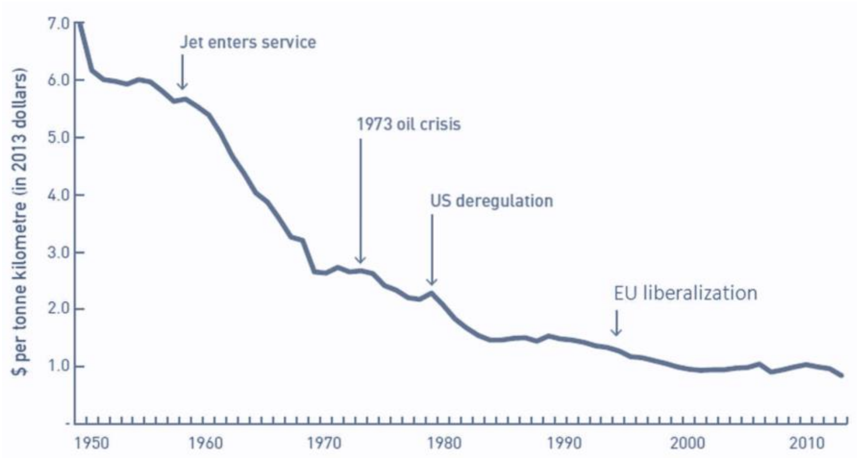

Figure 1.2 Evolution of average price of air travel ($ per revenue tonne kilometre)
Source [8] page 15

This decrease in cost has led to an increase in the accessibility of air travel – the democratisation away from a pursuit just for the wealthy to a part of normal, middle-class life, especially in the developed world. With 2017 extending the safest period in aviation history, people are continuing to take to the skies in record numbers. In 2017, 48% of Americans flew on an airline and 88% had taken a commercial flight in their lifetime, according to the Air Travelers in America report [3, page 3]. Comparatively, in 1977, just 25% of Americans had taken a flight that year and only 63% had flown in their lifetime. Other OECD countries show similar dynamics while flying is also becoming increasingly accessible in the developing world, with low-cost carriers opening up business and leisure travel to more and more citizens.

Among 2017 flyers, 71% of all trips were taken for personal reasons, up from 2016 and 2015, reflecting both an improving economy and the increasing availability of affordable, accessible airfare options. According to the survey, 2017 flyers took an average of 5.3 flights in 2017, including 2.6 for personal leisure purposes [3; page 4]. Moreover, in 2017, flying continues to be an extremely accessible and affordable mode of transportation, with the average American adult taking 2.5 airline trips in 2017 [3; page 4].

According to an Ipso survey done in January 2018 [3], in 2017, passengers were most satisfied with the process of checking in for their flights, followed by shopping and purchasing a ticket, the boarding process, reliability of on-time departures and arrivals, getting through security and awaiting checked baggage upon arrival (exact numbers are presented in Fig. 1.4). These results both give the perception of the customers, which is very important, but also clearly suggest areas on improvement. With the help of more advanced technological solutions, the time spent getting through security and the period dedicated to awaiting the luggage could be reduced.

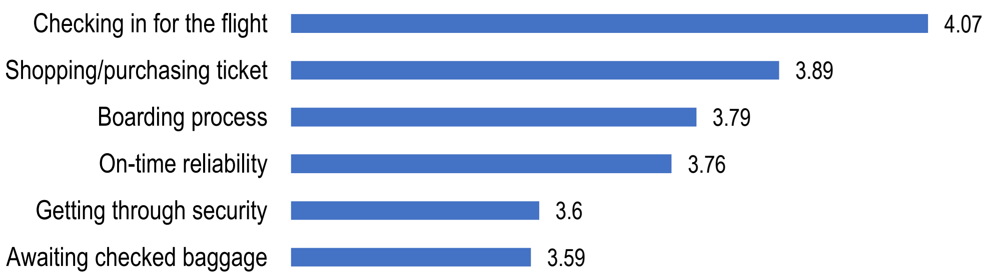

Figure 1.3 In 2017, on a scale of 1 (very dissatisfied) to 5 (very satisfied), how would you rate your overall satisfaction with each of the following ?
Source: [3] page 10

Affordability of airfare is a major factor that impacts the leisure travellers. As visible in (Table 1.1), when selecting which airline to fly, leisure travellers value affordability above everything else, followed by flight schedules, reliability of on-time departure and arrival, airline seat comfort, customer service, airline frequent flier programs, the quality of amenities and lastly environmental responsibility of the airline company.

Table 1.1 When traveling for personal reasons, how would you rank the following in terms of choosing which airline to fly, with 1 being your first priority and 8 being your last priority

Criteria	Rank in 2017 (Rank in 2016)	Score 2017 (Score 2016)
Affordability (airfare / ancillaries / taxes)	1 (1)	2.50 (2.65)
Flight schedule (routes, timings)	2 (2)	3.12 (3.23)
Reliability of on-time departure and arrival	3 (3)	4.22 (4.28)
Airline seat comfort	4 (4)	4.54 (4.45)
Customer service (reservation/gate agent, flight attendants)	5 (5)	4.82 (4.95)
Airline frequent flyer program (team/redeem/upgrade/status)	6 (6)	5.19 (5.00)
Quality of inflight amenities (food/entertainment/ Wi-Fi)	7 (7)	5.32 (5.17)
Environment responsibility	8 (8)	6.28 (6.26)

Source: [3] page 27

Business travellers also value affordability, but not as much as their preferred airline frequent flyer program and flight schedules. In 2017, 38% of passengers reported flying at least once from an airport not closest to their home or office. Of those choosing an airport other than the one closest to their home or office, 33% were willing to travel up to an hour for the best price; 12% were willing to travel up to 2 hours [3, page 26].

1.2.1 Low-Cost Carriers and the Affordability of Airfare

LCCs partnering with travel agencies. Aiming to gain more market and to expand their distribution channels, the low-cost and hybrid carriers (LCCs) have created a solid distribution channel via travel agencies. Amadeus [4, page 2] reports that LCCs tickets are now sold via the travel agency channel, which is an impressive evolution over the last decade. Ten years ago, LCCs sold almost exclusively via their websites [4].

As LCCs increasingly integrate travel agency sales into their plans for future growth and profitability, the demand for their fares and offers is also growing. Today's travellers are asking for more choice, options and value for money. This means travel agencies need, more than ever before, offers that are easily comparable, comprehensive and that include LCCs.

The most successful LCCs have adapted their offering to fulfil the key needs of travel agencies, which are: attracting customers, converting customers, retaining customers in the overall context of increasing efficiency.

These are the top five best practices, according to Amadeus [4], that the LCCs adopted aiming to having a successful partnership with travel agencies. First, is to offer competitive fares, so that travel agencies can offer their clients the best trip planning experience with a wide range of travel options. Secondly, LLCs adapted their products so that to be able to offer the travel agency customers a product that is tailored for their needs. Thirdly, LCCs managed to reduce their call centre cost by letting the travel agents do the job of converting and retaining customers via services and post-booking experience. This feeds into an additional need of the travel agencies to be efficient and save time during the booking and servicing process to which the LCCs responded by connecting to agents in the most efficient way. Finally, LCCs work in partnership with travel agents aiming to achieve an overall increase in efficiency for both parties.

New type of tickets. During the last decades, based on more advanced IT applications, better and better new software for ticketing became possible. This development meant less paper involved, faster services for customers and also new jobs implied by the software design, maintenance and support of e-ticketing systems.

In order to enable passengers to fly more at attractive prices, the airlines companies constantly create new types of tickets. For examples, of April 30, 2018, EL AL [40] offers three new types of flight tickets in Economy Class for all flights to Europe: *Lite, Classic* and *Flex*. These tickets are differentiated by the number of services the airline offers, such as type and weight of luggage allowed, type of meal, seat selection, the possibility to change the ticket or eve to cancel the booking.

1.3 Dynamics of Airport Connectivity

Airport connectivity is very important, as much so that, according to Olivier Jankovec Director General ACI Europe, "the European Commission has placed air connectivity at the core of its Aviation Strategy, which itself is part of its plan for Growth, Investment & Jobs. A reminder that the link between connectivity and GDP remains above politics, above walls and beyond dispute - even in these tumultuous times." [1, page 5]

The air transport network is dynamic and constantly developing. It is composed of over 1,400 scheduled airlines, over 26,000 aircraft in service, 3,900 airports and 173 air navigation services providers. It is truly a global industry connecting seamlessly all parts of the world [35]. *IATA* worked closely with *InterVISTAS* consulting to analyse the relationship between a country's level of connectivity to the global air transport network and its level of productivity and economic growth. Aviation connectivity is a measure which reflects the range and economic importance of destinations, the frequency of service and the number of onward connections available through each country's aviation network. The *InterVISTAS* model shows that connectivity has a statistically significant relationship with labour productivity levels. It shows that a 10% rise in connectivity, will boost labour productivity levels by 0.07% [1].

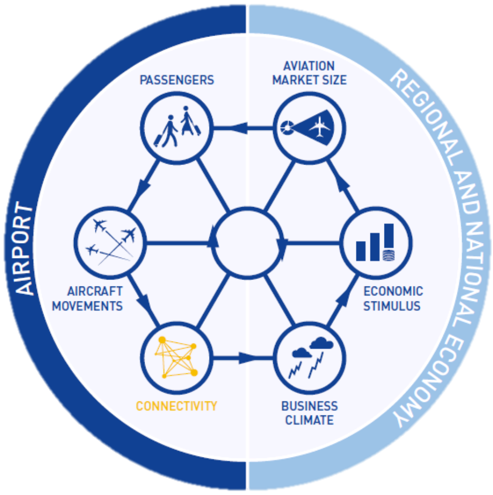

Figure 1.4 The virtuous circle of connectivity
Source: [1] page 2

1.3.1 Types of Air Connectivity

Direct Connectivity. These are the direct air services available from the airport – measured not just in terms of destinations, but also in terms of frequency.

Indirect Connectivity. This measures the number of places people can fly to, through connecting flights at hub airports from a specific airport. Indirect connections are weighted according to their quality, based on connecting time and detour involved with the indirect routing.

Total Airport Connectivity. This considers both direct and indirect connectivity from the airport. Airport connectivity is defined as the sum of direct and indirect connectivity – thus measuring the overall level to which an airport is connected to the rest of the World, either by direct flights or indirect connections via other airports.

Hub Connectivity. This is the key metric for any hub airport big or smaller. It measures the number of connecting flights that can be facilitated by the hub airport in question – considering a minimum and maximum connecting times and weighting the quality of the connections by the detour involved and connecting times.

Keywords for air connectivity analysis:

- indexes for direct, indirect and hub connectivity based on both quantitative and qualitative metrics
- direct and indirect weekly frequencies, weighted by their quality
- connectivity is a composite measure of the number of destinations, the frequency of services and the quality of the connections (in the case of hubbing or indirect services).

Key Insight

The EU market is leading connectivity gains in 2017 (+4.3%), with non-EU market growing at a slower pace (+1.4%) - mainly due to connectivity losses in Turkey (-6%) and Norway (-2%). Direct connectivity in the EU outperforms indirect connectivity gains (+5.4% versus +3.8%) – reflecting continued & increased market penetration by Low Cost Carriers (LCCs)

Since 2007, Europe's direct connectivity gains (+16%) has been entirely driven by LCCs – while Full Service Carriers (FSCs) have seen their direct connectivity decrease by -8%. While LCCs now account for nearly a third of Europe's direct connectivity (up from just 13% in 2007), 98% of their direct connectivity remains focused on linking airports within the intra-European market. The bulk of Europe's direct connectivity to other world regions remains the preserve of FSCs – where they keep growing their offer (+30.6%). However, LCCs have also started providing direct connectivity to external markets – mainly to North America.

Smaller airports (less than 5 million) that are close to large airports are no longer leading direct connectivity growth – reflecting that LCCs have moved upmarket & into larger airports.

Amsterdam-Schiphol is now the number 1 airport in Europe in terms of direct connectivity – having replaced London-Heathrow in that position since 2016. Frankfurt, Paris Charles de Gaulle and Istanbul-Atatürk are also included in the top 5 European airports offering the highest levels of direct connectivity.

Frankfurt remains the airport offering the best hub connectivity in the world – followed by Amsterdam-Schiphol, Dallas-Fort Worth, Paris-Charles de Gaulle and Atlanta.

EU Market Leading Connectivity Expansion

In 2017, overall average airport connectivity increased by +3.8%, reflecting significant airline capacity expansion. Most of the connectivity gains came from the EU market at +4.3%, where Cyprus, Latvia, Lithuania, Malta and Portugal achieved double-digit growth. Connectivity in the non-EU market grew at +1.4% - mainly due to connectivity losses in Turkey (-6%) and Norway (-2%) as well as limited gains in Switzerland (+1%) (Fig. 1.5).

1.3.2 New Connectivity Patterns

Direct connectivity remained the main driver of airport connectivity growth – again driven by significant gains in the EU market (+5.4%). Since 2007, direct connectivity across Europe increased at less than half the pace of indirect connectivity (16.3% vs. 39.6%) [1] (Fig. 1.5).

This new trend reflects the expansion of Low-Cost Carriers (LCCs), whose traffic has remained – for now – mostly point-to-point. Hence, unlike Full Service Carriers (FSCs) with their strong focus on transfer traffic based on hub & spokes operations, LCCs only have marginal impacts on indirect connectivity. It may also be, to a lesser extent, a reflection of airport capacity limitations at larger & hub airports – which tend to constrain indirect connectivity developments. In the future, direct & indirect connectivity dynamics may change again – with LCCs' business model evolution potentially leading to these carriers developing indirect connectivity.

The largest increases in connectivity over the past 10 years have been to the Middle East (+109.2%) - on the back of the significant expansion of Gulf carriers - as well as to Asia Pacific (+73.6%), followed by Latin America (+47.2%) and Africa (+45.8%) (Fig. 1.6).

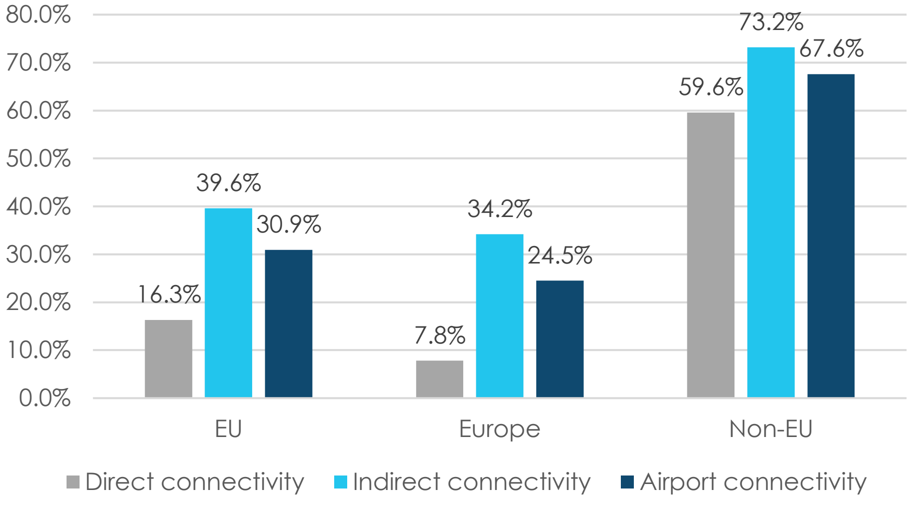

Figure 1.5 Direct, indirect and airport connectivity 2017 vs 2007
Source: [1] page 11

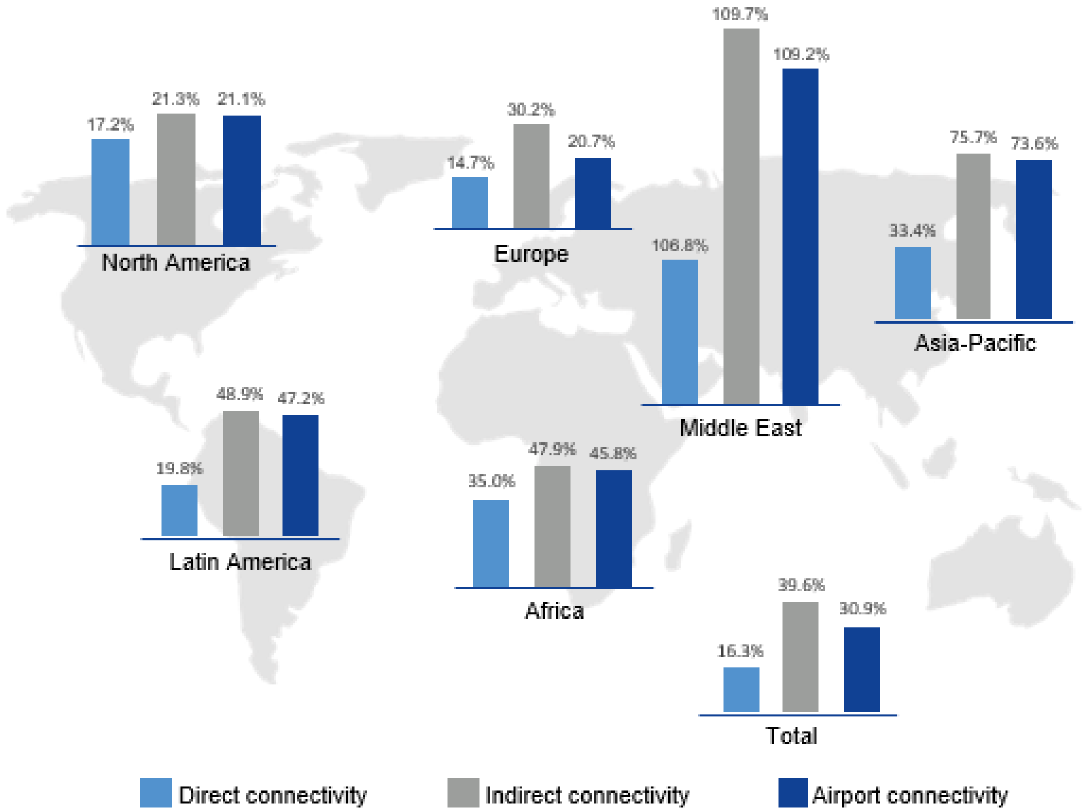

Figure 1.6 Direct, indirect and airport connectivity 2017 vs 2007
Source: adapted from [1] page 11

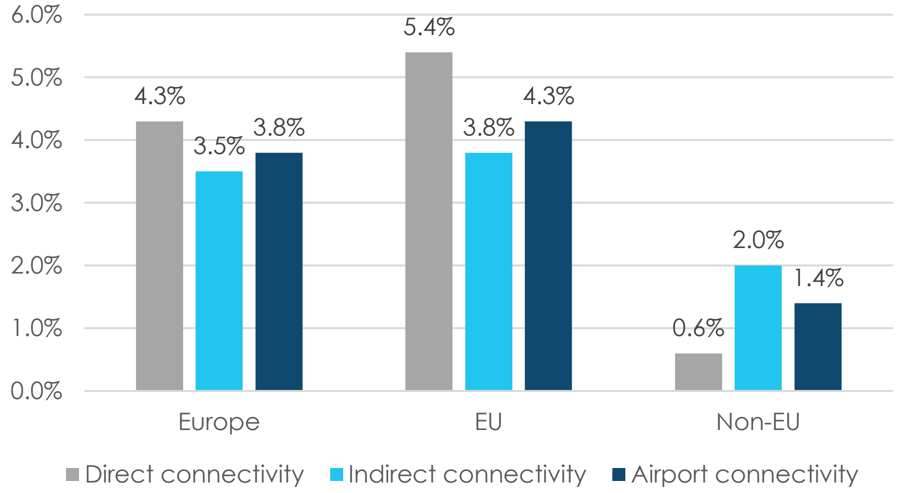

Figure 1.7 European airport connectivity: direct, indirect and airport connectivity 2017 vs 2016
Source: [1] page 10

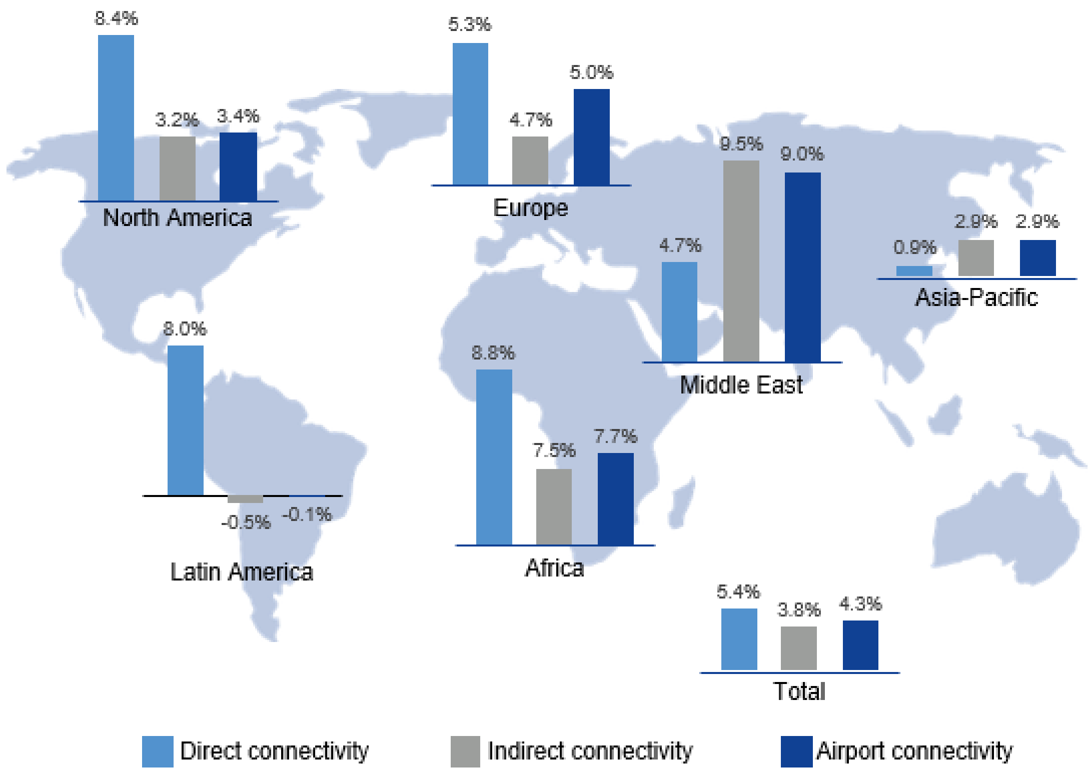

Figure 1.8 direct, indirect and airport connectivity from EU airports 2017 vs 2016
Source: adapted from [1] page 13

Direct Connectivity Gains Driven by LCCs

Looking at the past 10 years, Europe's direct connectivity gains (+16%) are entirely attributable to LCCs as result of their dynamic expansion and the relative retrenchment of FSCs (and others) – which have seen their direct connectivity decrease by -8%. Accordingly, LCCs now account for nearly a third of Europe's direct connectivity (Fig. 1.14).

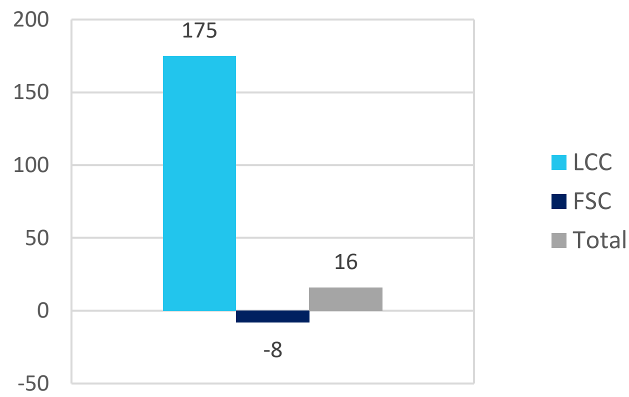

Figure 1.9 Direct connectivity 2017 vs 2007 (%)
Source: [1] page 12

European Hub & Direct Connectivity Dynamics

The past 10 years have seen significant changes in hub connectivity rankings amongst the top 20 airports – once again revealing how the competitive dynamics and specific local circumstances play a role as well (airport capacity constraints, terminal infrastructure developments and the fate of their home-based carrier).

Table 1.2 Connectivity by country involved in KAAT project

Country	Airport connectivity	Direct connectivity	Indirect connectivity	Hub connectivity	GDP 2015 (m€)	Growth 2017 vs. 2016 (%)			
						Airport	Direct	Indirect	Hub
France	43 130	14 409	28 721	49 386	2 180 113	2	1	2	-2
Italy	39 557	11 837	27 719	14 895	1 641 728	4	5	3	-3
Portugal	12 016	4 181	7 835	6 017	179 462	11	15	10	13
Romania	4 765	1 727	3 038	305	160 392	6	18	1	9
Croatia	4 133	1 187	2 946	67	43 922	11	17	9	447
Slovakia	167	126	41	5	78 651	7	-14	1	14

Source: [1] page 38-39

1.4 Air Traffic Dynamics and Forecast

A conservative analysis suggests that the global demand for air transport will increase by an average of 4.3% per annum over the next 20 years. That implies that demand for air travel will increase by a factor of 2.3 over the period.

If this growth path is achieved, then in 2034 the air transport industry will contribute [7, pg. 78]:

- 15.5 million direct jobs and $1.5 trillion of GDP to the world economy;
- including indirect and induced contributions, 46.4 million jobs and $3.8 trillion in GDP;
- once the impacts of global tourism are considered, a total of 97.8 million jobs and $5.7 trillion in GDP (considering the OPEN SKIES Liberalised Scenario) (Fig. 1.10).

At the level of full year 2017, according to ACI analyse [1], at the European level:

- fastest passenger traffic growth in 13 years
- biggest gains were at non-EU airports and in the Eastern & Southern parts of EU
- TOP 5 European airports welcomed an additional 18 million passengers
- passenger traffic growth up 30% over the past 5 years
- airport capacity constraints becoming more widespread & evident.

Passenger traffic across the European airport network grew by +8.5% in 2017 (Table 1.4) [2]. Both the return of a growth dynamic in the non-EU market and the continued expansion of passenger volumes in the EU contributed to this exceptional performance.

Passenger traffic at non-EU airports posted an average increase of +11.4% (compared to a decrease of -0.9% in 2016), with Russian and Turkish airports enjoying a bounce back. Airports in Georgia, Ukraine, Moldova and Iceland grew in excess of +20% on average.

Meanwhile, EU airports saw passenger traffic increasing by +7.7%, a further improvement over 2016 (+6.7%). The highest growth was achieved by airports in East and South of the EU – with airports in Latvia, Estonia, Poland, the Czech Republic, Slovakia, Hungary, Croatia, Slovenia, Romania, Bulgaria, Cyprus, Malta and Portugal recording double digit growth.

Freight traffic across Europe's airports grew by +8.5% in 2017 (compared to 2016) reflecting a cycle of sustained and synchronised expansion in the Global economy and in Europe in particular [2] (Table 1.4). Aircraft movements increased by +3.8% in 2017 compared to the previous year, on the back of continued airline capacity expansion (Table 1.4).

The top 5 European airports ('the Majors') saw passenger traffic growing by +5.5% in 2017 - collectively welcoming an additional 18 million additional passengers. This significantly improved performance compared to the preceding year (+1.5% in 2016 compared to 2015) reflects both the continued expansion of Low-Cost Carriers (LCCs) in primary markets and the better fortunes of these airports' hub carriers.

Amsterdam-Schiphol airport grew at the fastest pace (+7.7%), confirming its 3rd position with 68.5 million passengers, just behind Paris Charles de Gaulle (69.5 million passengers, +5.4%). This ranking is likely to change in 2018 as Amsterdam-Schiphol has now reached its capacity limits and growth at Istanbul-Atatürk is accelerating (+15.9% in December).

Meanwhile, London-Heathrow remained the busiest European airport with 78 million passengers (+3%). Moreover, Frankfurt airport posted the second-best performance (+6.1%, 64.5 million passengers) and held onto its 4th position, followed by Istanbul-Atatürk (+5.9%, 63.9 million passengers).

Table 1.3 Projected annual growth rate for international traffic by region 2016 – 2034

Region	Forecast Growth [%]
Africa	4.9
Asia-Pacific	5.5
Europe	3.4
Latin America & Caribbean	4.2
Middle East	5.8
North America	2.7
APEC	4.3
European Union	3.4
Small Island States	4.0
Developing Countries	5.0
OECD Economies	3.5
Least-Developed Countries	5.2
Landlocked Developing Countries	5.0

Source: [7] pg. 7

Table 1.4 Europe traffic development by categories

	Full Year 2017/2016 (%)	Full Year 2017/2015 (%)	Full Year 2017/2014 (%)
Total Passengers	8.5	13.9	19.9
Passengers International	9.7	15.4	21.3
Passengers Domestic	5.5	10.3	16.4
Freight	8.5	14.5	15.1
Movements	3.8	6.4	8.7

Source: [2] pg. 32

Table 1.5 Passenger Development European Countries Involved in KAAT Project (Full Year 2017)

Country	Passenger Development (%)
Portugal	16.6
France	6.0
Italy	6.7
Slovakia	10.7
Croatia	16.6
Romania	23.5

Source: [2] pg. 34

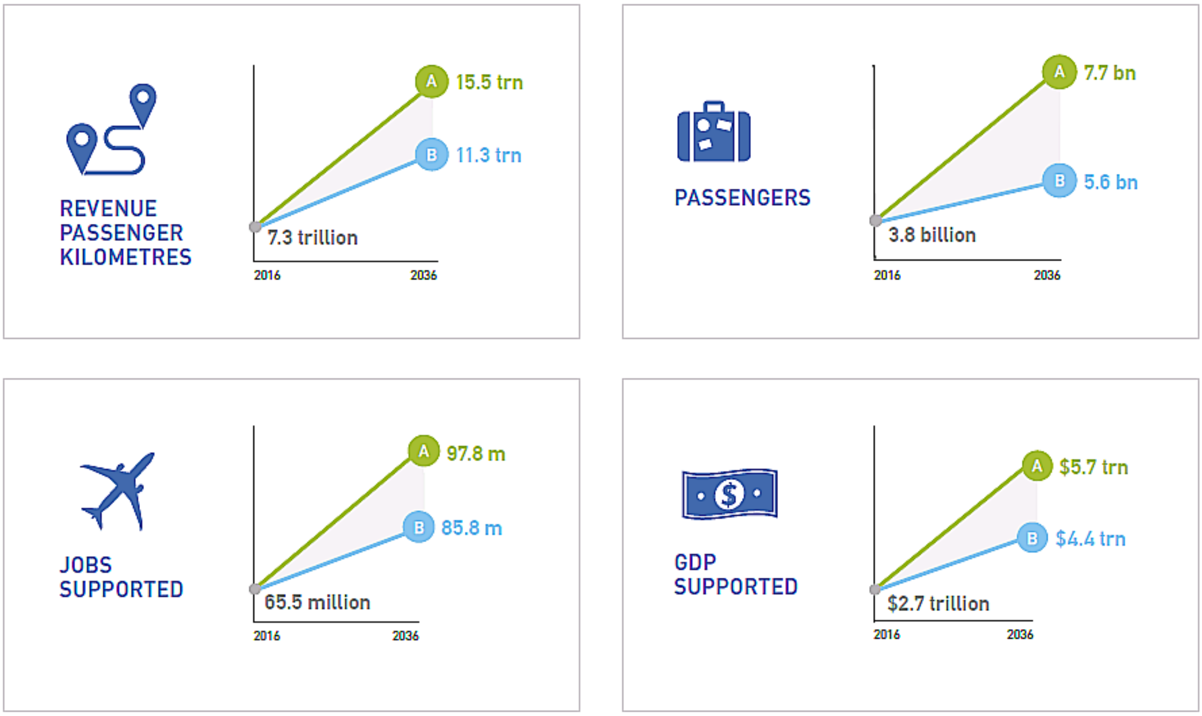

Figure 1.10 An assessment of the next 20 years of aviation (A = Open Skies Liberalised Scenario, B = The Global Fragmentation Scenario)
Source [7] pg. 78

Table 1.6 Europe Air Traffic – Figures by Partners in Project

No.	City	Code	Passengers			Commercial Movements		Freight	
			Full Year 2017	2017/16	2017/15	Full Year 2017	2017/16	Full Year 2017	2017/16
1	Paris	CDG	69 473 157	5.4 %	5.6 %	475 645	0.6 %	2 008 658	2.9 %
2	Rome	FCO	40 968 756	-1.8 %	1.4 %	2 940	-5.2 %	179 615	15.9 %
3	Paris	ORY	32 040 870	2.6 %	8.0 %	229 015	-2.3 %	91 809	-7.2 %
4	Lisbon	LIS	26 663 385	18.8 %	32.7 %	199 261	11.5 %	115 777	25.5 %
5	Bucharest	OTP	12 804 959	16.6 %	37.9 %	113 310	8.7 %	34 34534	11.5 %
6	Zagreb	ZAG	3 086 740	11.9 %	19.8 %	37 028	1.3 %	7 770	41.4 %
7	Cluj	CLJ	2 699 286	43.2 %	81.5 %	24 476	30.8 %	2 928	39.4 %
8	Bratislava	BTS	1 941 903	10.7 %	36.1 %	17 076	6.2 %	26 224	15.1 %
9	Timisoara	TSR	1 621 753	39.6 %	75.4 %	26 733	24.3 %	4 586	21.2 %
10	Iasi	IAS	1 146 445	30.1 %	8.3 %	11 407	15.1 %	17	21.4 %

Source: [2] pg. 34-39

Sustaining the future of aviation by 2034, both air passenger traffic and air freight traffic are expected to more than double, compared to 2016. Passenger traffic is expected to reach over 14 trillion RPKs with a growth of 4.6 per cent per annum, and freight will expand by 4.4 per cent annually over the same time period, to 466 billion FTKs (Fig 1.1).

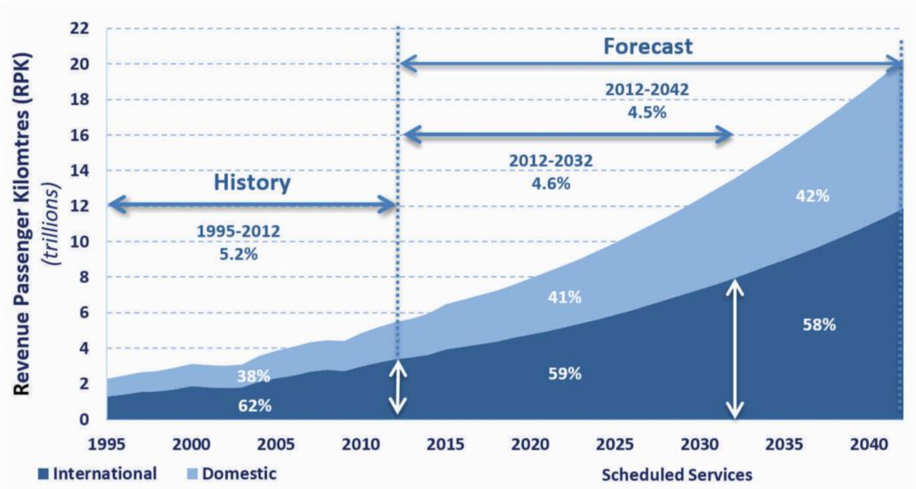

Figure 1.11 Total passenger traffic: history and forecast
Source: [8] pg. 11

This growth holds tremendous economic potential which will support all States in achieving the UN's 2030 Agenda for Sustainable Development. In 2034, aviation will provide 99 million jobs and generate USD 5.9 trillion in GDP, a 122 per cent increase from 2014 (Fig. 1.11). The future growth of air transport will likely depend on the sustainable world economic and trade growth, as well as declining airline costs and ticket prices. Other factors, including regulatory regimes (such as liberalization of air transport), technological improvements and fuel costs will also impact future growth. If traffic growth were to slow by just one per cent annually, the total number of jobs supported by the air transport sector would diminish by over ten per cent (more than 10 million jobs) and the contribution of the air transport sector to world GDP would drop by some 12% (USD 690 billion). To encourage the projected growth in a sustainable manner and produce inclusive and productive development and employment, aviation must continue to develop coherent policies with tourism, trade and other transport sectors. A national or regional policy framework consistent with ICAO's standards and policies, and with globally accepted good regulatory practices, can unlock the full value of aviation. New technologies and procedures should also be adopted to further improve connectivity and modernize infrastructure while minimizing any possible adverse impacts of this growth on the environment.

The estimated employment development includes also new jobs which imply new qualifications or new capacities to ensure the increasing number of employees. Sustainable development means ensuring interdisciplinary qualifications with competences in air transport and sustainable development or air transport and green energies. For these reasons, new interdisciplinary study programmes should be already designed and implemented. Current jobs also imply new competences, particularly skills for ICT and green technologies.

1.5 Digitalisation of Airports

Over the past 10 years, several business terms have come into common usage in the aviation industry: “connected traveller”, the “smart airport”, the “self-service airport”, the potential for in-terminal “location-based services”, management “process visualisation” and “collaborative decision-making”. All these terms relate to the ongoing digital transformation of airports which is not a new trend but something which has been evolving for decades. Since the first automated baggage sorting systems appeared in the 1990s and the first e-ticket was issued in 1994 it has affected both the passenger journey and internal processes.

Figure 1.12 Examples of smart airport applications:
Source: adapted from [69]

Looking to the overall rate of digitisation adoption, airports are considered laggards compared to other industries. This is mainly due to their traditional business to business (B2B) business model and heavy reliance on aeronautical revenues. Today however, with non-aeronautical revenues becoming a driving force and passengers an increasingly important customer segment, airport digital marketing is growing more sophisticated.

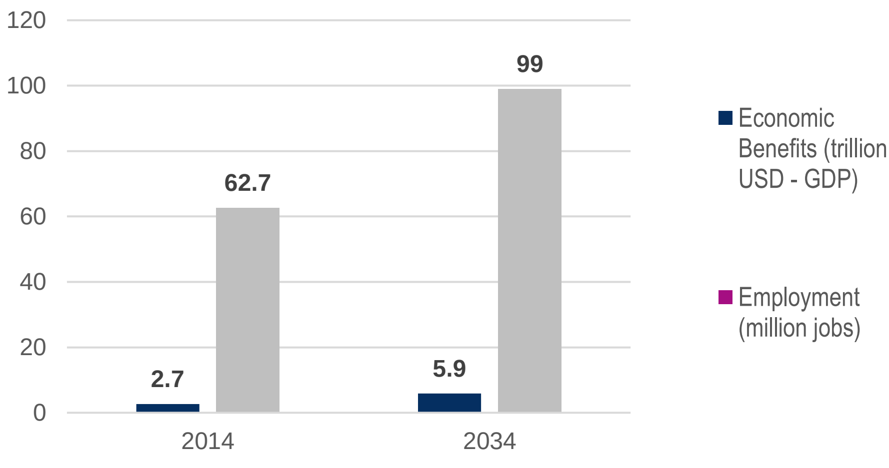

Figure 1.13 Aviation benefits
Source: [8] page 11

Now digital transformation of airports is intensifying and manifested by digitisation, connectivity and big data trends (Fig. 1.14 – 1.15).

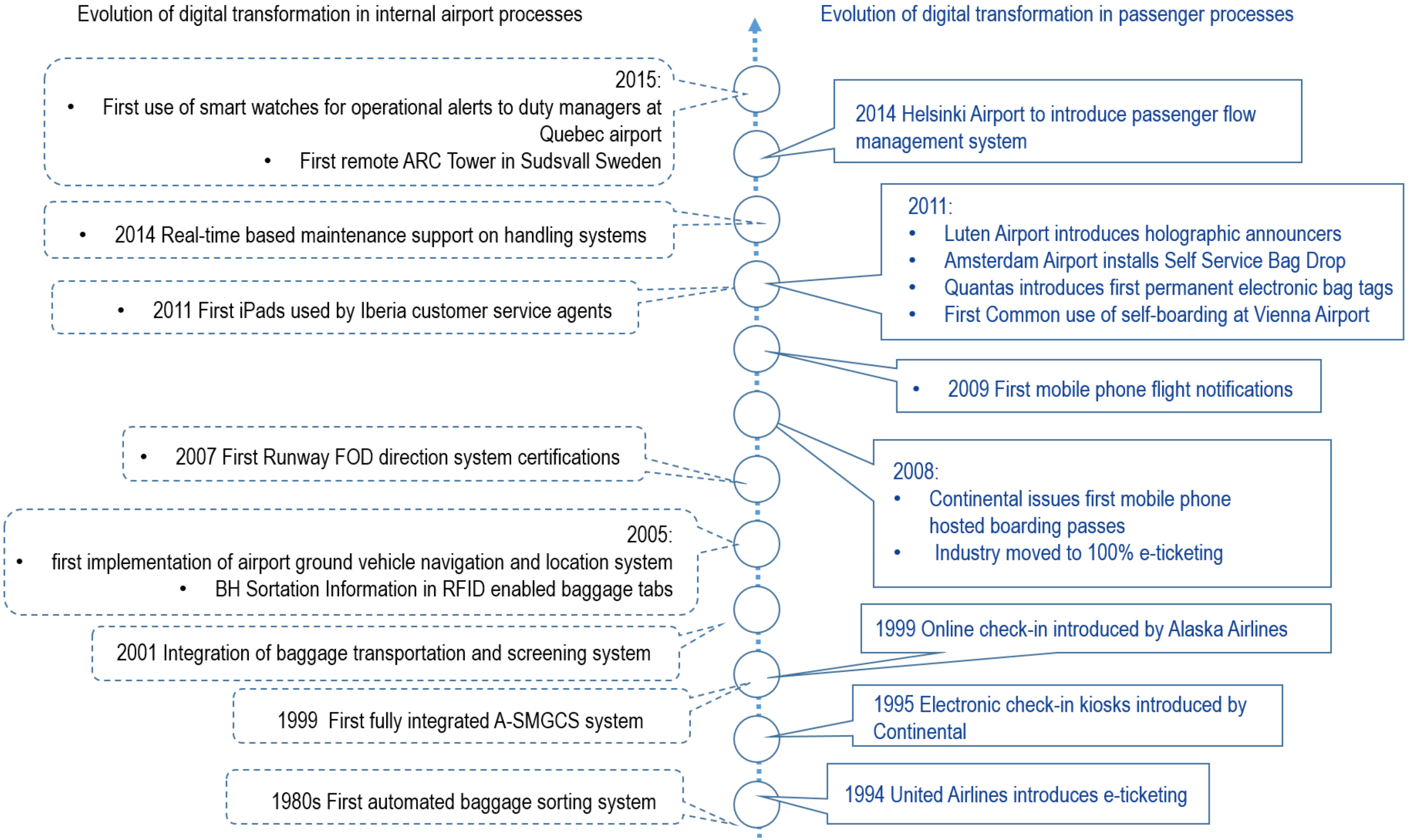

Figure 1.14 Evolution of digital transformation in passenger processes and in internal airport processes
Source: Adapted from [69]

Connectivity of systems, people and things

System connectivity is manifested through the evolution of the Airport Collaborative Decision Making (A-CDM) concept. Airports implementing A-CDM act as data intermediaries and a single source of truth for stakeholders as diverse as airlines, ground handlers and even passengers.

Going forward it will generate the introduction of innovative products and services. For example, community applications providing full and real-time visibility across all possible parameters and processes to an expanding list of relevant stakeholders. It will also gradually move towards intercommunity CDM to allow shared projects across multiple airports located in different regions and countries.

Connectivity of people differentiates between employees and passengers. The first is driven by airport Resource Management Systems (RMS) and the need to improve productivity and processes. Employees are now being issued with portable devices, such as iPads and smart watches, tracking their movements through the airport and providing real-time information on the go.

However, it tends to be passenger connectivity which features prominently in media reports and management workshops. Passenger connectivity is particularly valuable to airports as, for the first time, it offers two-way direct exchanges without an airline acting as the communication gatekeeper.

Two-way communication sits at the core of Location-based Services (LBS) and is the single biggest driver of airport innovation. Airports are expected to develop new business models to provide, for example, real-time, contextual promotions to passengers passing by or browsing in Terminal retail stores. Making a success of these models may not be straightforward and will certainly require extensive trial and error before the right approach is established.

Monitoring passenger flow also supports process improvement. It can be enabled by capturing signals from smartphone-hosted technologies (e.g. Bluetooth, Wi-Fi, NFC); installing sensors in the terminal building (e.g. Infrared); or using algorithms to analyse data from older technologies (e.g. CCTV-based analytics).

There is an interesting parallel with the online browsing experience. Like online marketers, airports are now equipped with the equivalent of cookies (i.e. data recorded through beacons or other sensor technologies) to track the passenger journey and transactions from kerb to gate.

Digital transformation of airports is intensifying and manifested by digitisation, connectivity and big data trends.

Big Data applications in digital transformation of airports

Big Data is the result of the digitisation process and the evolution of connectivity. Trends in digitisation and connectivity define the airport of today, but Big Data will define the airport of the future.

Airports are now recognising the need for Big Data Analytics (BDA) as they focus on optimising processes, improving productivity and minimising costs; while evolving from B2B to B2C organisations.

Many of the analytics solutions currently used by airports relate to Business Intelligence (BI i.e. management dashboards and reporting) to support performance management and traffic flow forecasting for short- and long-term planning.

In future, however, airport managers will use analytics to help them visualise airport operations in 3D and based on real-time data inputs. It is also conceivable that airport systems will be taking automated actions on behalf of managers to remove bottlenecks and improve efficiency. This will be the first manifestation of Artificial Intelligence (AI) in the airport environment.

Benefits of digitalisation to airport managers

- Process Optimisation
  - Enabling an airport's Business Process Improvement (BPI) team to identify problem areas, measure performance and take necessary actions
  - Allowing both short term and long-term planning
  - Improving employee productivity
  - Delivering synergies amongst stakeholders
  - Reducing costs
- Business Model innovation
  - Allowing the development of new non-aeronautical revenue streams, thereby enhancing the creative campaign process
  - Enables, for the first time, airports to know and segment airline passengers in order to offer new services to the right people at the right time and at the right price
- Customer Experience improvement
  - Improvement will come through process optimisation and business model innovation, but could be targeted specifically through digital transformation
  - Allows airports to develop unique services to facilitate the passenger journey through each and every airport touchpoint

Current trends

Some airports, such as Geneva, Doha International and Dubai International, have defined clear objectives on using digital technologies to build brand equity and been perceived as industry innovators. Düsseldorf went a step further by deciding fund innovation.

Others, such as London Gatwick may prefer to take smaller steps and focus on improving processes in smaller areas with a multitude of measurable benefits. There is no right or wrong approach in the speed of innovation, nor in the project size, if there is a clear vision. After all, the digital roadmap should be linked to the strategy map, whether the airport is building a digital terminal or a smartphone application [60].

The future checkpoint

The evolution of technology has brought a range of opportunities to operations and has driven the "smart airport" concept. The foundation of these concepts is to help airports better understand their customer, provide better and more tailored services, and enable seamless travel. The figure below shows some of the largest transformational shifts in airports over the next 15 years.

One of the key considerations in this transformation is the security requirements. However, the critical challenge of is how to provide high levels of security whilst increasing passenger throughput and decreasing wait times remains. There is continued focus on checkpoint and security screening operations which are a stress point for passengers. If these are not delivered in a smooth and efficient manner it can significantly affect passenger's opinion, experience and expenditure at the airport.

Heightened security events and attacks on airports over the last years have driven conversations about airport security and the checkpoint of the future. Airport security and legislation have been reactive to emerging threats such as Liquid Explosive Detection and explosives in shoes and laptops.

However, many of the recent high-profile attacks such as those at Brussels Zaventem International Airport in March 2016 and Ataturk Airport in Turkey in June 2016 have all occurred before the security checkpoint. It has fuelled the debate on the security checkpoint of the future, and whether these should be placed before entering the terminal building. In many airports throughout the world, including Turkey, there is a screening process to enter the terminal buildings. However, this still did not prevent the attacks being carried out at the site.

Currently IATA and the Airports Council International are driving the SMART security concept, looking to disrupt traditional screening across several processes including: Passenger Screening, Cabin Baggage Screening, Alternative Detection Methods and Unpredictability, Checkpoint Environment and Management, Centralized Image Processing.

Security checkpoints will become more free flowing without requiring passengers to remove laptops from bags, liquids, belts and shoes. By 2030 it would expect pre-qualified security and walk through security tunnels to become the standard with no need to unpack. This is, however, reliant on authorities understanding the risk before passengers or persons of interest arrive at the terminal.

New qualifications and jobs related to the digitalisation of the airports

Digital transformation demands a different skill set from workers in today's economy and will create new types of jobs. Aviation, travel and tourism players will need to adapt to this transition, as digital transforms the ecosystem, with change being driven by people from within the organization. Challenges such as managing the impact of automation on employment, reskilling the industry workforce for the digital economy, and creating a safety net for workers in a flexible workforce, will need to be tackled collaboratively by industry, regulators and policy-makers.

In the future the use of Big Data will enable the collection of several information about passengers (e.g. biometrics, travel behaviour), that will be used for the passenger pre-selection process. In the next years, machine will be able to read the x-ray will probably substitute or change some of the working activities currently performed by the security screening officers at airports.

The emerging occupations:

- Software and AI engineers
- Big Data and analytics experts

- Security & cyber security experts
- Legal services personnel and ethics and privacy protection specialists
- Remote tower controllers
- Unmanned traffic controllers
- AI engineers/VR experts
- Big data analysts
- Robotics engineering.

These new occupations will require new additional skills and not to replace the existing ones. This means adding new interdisciplinary qualifications and many returns to learn in order to upgrade the skills and knowledge.

These new occupations ask for new competencies. The aviation engineer of the future will require a mixture of technical and soft skills that are related to the current context of digitalisation and increasingly rapid technological change, including:

- Digital competencies (advanced analytics and big data, cloud and as a service platform, mobility, etc.);
- Design thinking;
- Entrepreneurial thinking;
- Cyber security skills;
- Skills related to virtual/augmented reality.

In Chapter nine we will propose new qualifications and for existing ones, new Knowledge, skills, social and personal attitudes and responsibility in order to respond to new demands and challenges of new trends in air transport and furthermore to new occupations presented above.

1.6 Greenisation of Airports

The greenisation of airports as related to the societal responsibility of the organisation refers to concrete climate and environment actions:

- develop renewable energies
- increase energy efficiency and reduce greenhouse gas emissions
- preserve natural resources
- closely monitor the quality of water and air
- share the good practices within the airport community.

For example, for the group of Aéroport de Paris (ADP), the roadmap for environment 2016 – 2020 contents the following concrete objectives by five domains [43] energy, buildings and constructions, air, emission, climate, water and waste that we shall detail below.

- Energy category refers to:
    - improve the energy efficiency
    - use of LED lighting (car parks, posts airplanes, taxiways and terminals)

- renovation of buildings
- increasing the percentage of renewable energy in the final consumption
- reduce CO2 emissions per passenger

➢ Buildings and constructions category refers to:

- certify the buildings by an environmental label
- keep and update a map of polluted sites and soils

➢ Air, emissions, climate category refers to:

- use of clean vehicles (hybrid, electric, etc.) in the fleet of light vehicles
- maintain / obtain ACA (Airport Carbon Accreditation) Level 3
- limit emissions from aircrafts at ground level
- continue actions allowing to reduce emissions accessing the airports

➢ Water category refers to:

- decrease of internal consumption of drinking water per passenger
- continue to improve the management of winter pollution

➢ Waste category refers to:

- increasing the valuation rate of non- dangerously waste
- collection services for bio-waste

The greenisation of the airports will need new qualifications and, consequently, will generate new jobs. As for example: Energy and maintenance engineer, Electrical engineer/ Alternative Vehicle Developers, Climate Change Reversal Specialist, Consumer Energy Analysts, Battery Technician or Solar Flight Specialists. Also, everyone involved in the field of the environment will follow a formation and a technical training.

2 Societal Responsibility

This section aims to clarify the concept of societal responsibility and give the definition that will be used throughout the current report, provide a brief overview regarding the regulations and the EC point of view. Additionally, it discusses the ISO 26000 standard and then it lists some of the key competences for societal responsibility.

Organizations around the world and their stakeholders are becoming increasingly aware of the benefits and the need for a socially responsible behaviour. The objective of societal responsibility is to contribute to sustainable development. An organization's commitment to the welfare of society and the environment has become a central criterion in measuring its overall performance and its ability to continue operating effectively.

Sustainable development has always been an objective of many fields, including the tourism and transportation sectors. The air transport industry is a part of the service sector that plays an important role in the transportation industry and in the tourism industry. Nowadays, since this sector is operating in a global competitive environment, one source of competitive advantages is corporate social responsibility as it contributes to the long-term value of the organization. In addition, the effects of corporate social responsibility on customer loyalty, as well as its identification of areas needing emphasis in terms of organizational involvement and support, has also improved. However, a major part of the air transport industry, deals with many negative impacts, such as air pollution, noise, CO_2 emission, and labour practices. Corporate social responsibility is a strategic business activity that can enhance the sustainability of this industry.

2.1 Understanding the Concepts

Societal responsibility is a relatively little used concept, due to the replacement or confusion with social responsibility. This concept implies that companies integrate social, environmental, and economic concerns into their activities and interactions with their stakeholders on a voluntary basis. More clearly and simply stated, it is "*the contribution of companies to the challenges of sustainable development*".

The French term is "*responsabilité sociétale des entreprises (RSE)*" and it refers to companies taking voluntary account of environmental, social and ethical issues in all their activities on a voluntary basis, i.e. exceeding sometimes the mandatory regulations.

Societal responsibility of enterprises is also called, according to various authors and specialists and the content given to it, "social responsibility". This can obviously be confusing since, according to some authors, "social" means all that concerns society, including the environment, not only relations between employers and employees and, in this sense, "social" and "societal" can be equivalent, covering the English term of corporate social responsibility (CSR) which is widely used.

However, the authors of this report consider that the terms "social" and "societal" are not equivalent, as "societal" designates everything about the society as a whole, so both the environment and the social relations.

Basically, the societal responsibility of an organization is a societal issue for which many actors have mobilized either to make recognize that companies did not assume their responsibilities enough, or conversely to argue that they could also assume beyond the only mandatory regulatory requirements.

There is therefore no single definition that can be used, and the practices are highly variable (most of which are known only to the companies themselves, directly (e.g. annual report) or indirectly (survey questionnaires). However, some proposals have a specific value: the ISO 26000 standard, adopted in 2010 or a standard of the European Commission, specified in a 2011 communication after its Green Paper in 2001.

Although the concept of societal responsibility has different definitions, the basic idea is to examine how businesses integrate stakeholder interests with social values in order to consolidate the relation between organization and society.

2.2 Regulations and Literature Review

In the past decade, corporate social responsibility (CSR) has been the primary subject of a limited number of studies from a small academic community of practice and these studies have primarily focused on three macro level topic areas: implementation; the economic rationale for acting more responsibly; and the social relations of CSR [19]. Both academics and practitioners have explored concepts like CSR, such as corporate social performance (CSP), corporate sustainability (CS), and environmental management (EM)[5].

2.2.1 Definitions

The definition of CSR can be broken down into three main aspects: equity–social concerns, ecological–environmental considerations, and economic mergers [27].

The World Business Council on Sustainable Development (WBCSD) has proposed a more extensive definition of CSR: “Corporate social responsibility is the continuing commitment by business to contribute to economic development while improving the quality of life of the workforce and their families as well as of the community and society at large” [68].

Common actions of societal responsibility actions include [49]:

- Environmental sustainability: recycling, waste management, water management, renewable energy, reusable materials, 'greener' supply chains, reducing paper use and adopting Leadership in Energy and Environmental Design (LEED) building standards.
- Community involvement: This can include raising money for local charities, providing volunteers, sponsoring local events, employing local workers, supporting local economic growth, engaging in fair trade practices, etc.
- Ethical marketing: Companies that ethically market to consumers are placing a higher value on their customers and respecting them as people who are ends in themselves. They do not try to manipulate or falsely advertise to potential consumers. This is important for companies that want to be viewed as ethical.

2.2.2 European Commission's Point of View

In the document *Green Paper: Promoting a European framework for Corporate Social Responsibility [30]*, the EC describe Corporate Social Responsibility as a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis.

The European Union is concerned with corporate social responsibility as it can be a positive contribution to the strategic goal decided in Lisbon: "to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion". As corporate social responsibility contributes significantly to a favourable climate towards entrepreneurship, it is also linked to the Commission's objective of creating an entrepreneurial, innovative and open Europe – "Enterprise Europe".

Many factors are driving this move towards corporate social responsibility [30]:

- new concerns and expectations from citizens, consumers, public authorities and investors in the context of globalisation and large-scale industrial change,
- social criteria are increasingly influencing the investment decisions of individuals and institutions both as consumers and as investors,
- increased concern about the damage caused by economic activity to the environment,
- transparency of business activities brought about by the media and modern information and communication technologies.

2.2.3 ISO 26000 - Social responsibility

Business and organizations do not operate in a vacuum. Their relationship to the society and environment in which they operate is a critical factor in their ability to continue to operate effectively. It is also increasingly being used as a measure of their overall performance.

ISO 26000 provides guidance on how businesses and organizations can operate in a socially responsible way. This means acting in an ethical and transparent ways that contributes to the health and welfare of society.

ISO 26000:2010 provides guidance rather than requirements, so a company cannot be certified against this standard, unlike some other well-known ISO standards. Instead, it helps clarify what social responsibility is, helps businesses and organizations translate principles into effective actions and shares best practices relating to social responsibility, globally. It can be used by all types of organizations regardless of their activity, size or location.

The standard was launched in 2010 following five years of negotiations between many different stakeholders across the world. Representatives from government, NGOs, industry, consumer groups and labour organizations around the world were involved in its development, which means it represents an international consensus.

ISO 26000 was developed by a working group of about 500 experts. At the publication of this standard the working group was disbanded. However, the leadership of the working group was retained to provide support and expertise for users. This is now called the Post Publication Organization, or PPO, for ISO 26000.

The ISO 26000 PPO has produced the following document(s) to support the implementation of ISO 26000:

- Communication Protocol – Describes appropriate vocabulary organizations can use to communicate about their use of ISO 26000;
- ISO 26000 basic training materials in the form of a PowerPoint and training protocol guidance [PDF];
- Those that link ISO 26000 with the OECD guidelines for multinational enterprises and the UN Agenda 2030 (Sustainable Development Goals);
- Those for the Systematic Review of ISO 26000, due to begin 15 January 2017.

ISO 26000 addresses seven core subjects of social responsibility defined in the standard.

2.3 Societal Responsibility in Air Transport Industry

The dimension of societal responsibility of an organization refers to the areas and scope of the application of this as a business agenda. It is all about the social, ethical and the environmentally-friendly responsibilities a company should consider in their business. The societal responsibility of an organization is a multi-dimensional concept in terms of its objectives as it involves the interests of different types of stakeholders.

The internal dimension of societal responsibility includes human resource management, health and work safety, management of environmental impacts, and natural resources [30]. A general challenge for enterprises, and those in air transport industry are not an exception, is to attract and retain skilled workers and achieve the well-being of the employees. Since knowledge is a significant resource in our current society and the demand for more highly skilled workers has increased, employees became the most important and in fact the only remaining realistic challenge of competitiveness.

The workplace wellbeing refers to mental, psychological or emotional aspect of employee's life. The awareness of management on the employees' wellbeing which takes into consideration the employees' satisfaction, health and professional development is an effective approach in strengthening of an organizational performance. In this context, relevant measures could include lifelong learning, empowerment of employees, better information throughout the company, better balance between work, family, and leisure, greater work force diversity, equal pay and career prospects for women, profit sharing and share ownership schemes, and concern for employability as well as job security. For this component of societal responsibility, the people involved in these activities need to have knowledge and skills in communication, education, human resource and career counselling.

Corporate societal responsibility extends beyond the doors of the companies into the local community and involves a wide range of stakeholders in addition to employees and shareholders: business partners and suppliers, customers, public authorities and NGOs representing local communities or the environment. The external dimension of societal responsibility includes communication based on sustainable development with local communities, with business partners, suppliers, consumers. For this component of societal responsibility, the persons involved in these activities need to have knowledge and skills in sustainability, communication, environment and energy issues.

The societal responsibility strategy can be centred around **four pillars**: environment, customer experience (market place), employees (work place) and local development (community) (fig. 2.1.). These pillars should support the company's business model. With the initiatives and activities centred toward these outcomes, a company/ organization can have a positive impact on society and contribute to the achievement of UN Sustainable Development Goals.

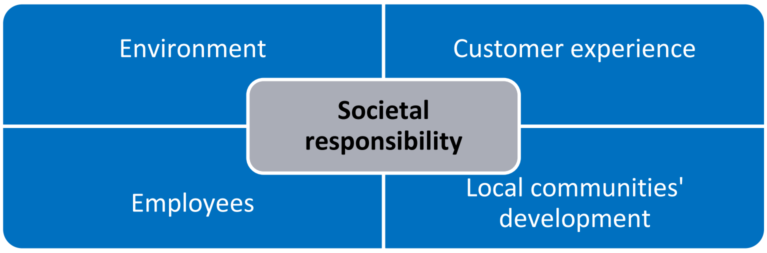

Figure 2.1 Pillars of societal responsibility

As an example of good practice, KLM has a very well-developed strategic plan for societal responsibility within the group, which describes all the necessary actions and steps for achieving proper results on all the mentioned categories and on the overall performance of an organization. According to them, the societal responsibility strategy contains four pillars/ actions, as is presented in the figure from above: environment, customer experience, responsible human resources and local development (fig. 2.2.)

Figure 2.2 Corporate societal responsibility pillars
Source: www.klm.com

2.4 Key Competencies for Societal Responsibility

Societal responsibility of an organization reaches virtually all industry sectors. Depending on the laws and regulation and also the voluntary commitments of the company, societal responsibility implies the creation and updating of a series of jobs. There is no consensus regarding the necessary competences and qualifications for such jobs, but we tried to establish some common requirements in the following paragraphs.

Societal responsibility of a company may be implemented within the human resources, business development or public relations departments of an organisation, or may be a separate unit reporting to the Chief Executive Officer (CEO) or the board of directors.

In the context of the European Qualification Framework (EFQ), each of the 8 levels is defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualifications, in term of *knowledge, skills and responsibility and autonomy*. Responsibility and autonomy are described as the ability of the learner to apply knowledge and skills autonomously and ***with responsibility***. Therefore, there should be a connection with the competencies necessary for a person who will develop and implement societal responsibility actions.

Based on interviews with stakeholders, we have drawn the conclusion that the key competencies for persons which will prepare and implement societal responsibility actions are the followings:

- Teamwork: persons working in societal responsibility of a company are required to work across departments and are responsible for collaborating with others.
- Communication: knowing how to communicate well, both verbally and written is a critical must-have skill for a career in corporate societal responsibility, being responsible for communicating everything and need to be able to tailor the message to different audiences and stakeholders.
- Systems thinking and connecting the dots: societal responsibility is a cross sectoral and often requires partnerships with other organizations, to be able to see the big picture and explain how the organization fits into the greater cause.
- Business Acumen: strategic thinking, sustainability, research, analytics, and marketing are some of the most common skill-sets looked for in a societal responsibility role (dependant on the company).
- Knowledge in the filed: particularly, to understand the business and current issues in air transport industry and the world.

Conclusions

Although there is no universally agreed definition of corporate societal responsibility at a global level, the concept has been settled and recognised as a long-term business strategy balancing corporate rights and ever-growing list of obligations towards stakeholders. It requires a company to consider the social, environmental and economic impacts of its business operations while considering the needs and expectations for each of its stakeholders.

There are no specific qualifications required for societal responsibility field but there are an increasing number of qualifications becoming available at master's level and as part of MBA courses. However, because it is relatively new, transferable skills and knowledge from other related specialisms such as environmental management, ethical finance, marketing and HR, are valued.

It is difficult to clarify what skills and competencies would be required for a societal responsibility role due to the interdisciplinarity of the issue and, consequently, to define the profile of HR implicated in this area. The skills required are interdisciplinary, these could be categorised into:

- *Business/ Professional skills* - including building insight, decision making, commercial awareness, IT, innovation, strategic awareness, leadership, handling complexity and problem solving)
- *Soft skills* - including communication skills, adaptability and empathy, developing others, teamwork, open minded, critical thinking, integrity, self-development and learning, building partnerships, team working, positive attitude, work ethic.
- *Technical skills* - including technical expertise, understanding impacts, stakeholder dialogue, internal consultancy, selling the business case, understanding human rights and understanding sustainability.

Given the importance of societal responsibility for a company and the complexity of the component actions, it is highly important to have qualified and well-trained persons working or leading these actions.

3 Labour Market, Education and Training in Air Transport

This section aims to briefly present the labour market in air transport, the education and training available in the context of the European regulation in terms of qualifications and the role of the currently developing project of Knowledge Alliance in Air Transport, to which this report is an integral part.

3.1 The Labour Market in Air Transport

The ICAO Report “Global and Regional 20-year Forecast” [39] shows that, for passenger and cargo aircraft groups, an average of 20 maintenance personnel is required per aircraft. Among the estimated 20 persons per aircraft, approximately one fourth is licensed maintenance personnel. The maintenance personnel population in Europe will increase between 2010 and 2030 by a factor 3.9 and so the region experiences a significant annual training shortage of 8,352 people. Furthermore, the next generation of maintenance personnel will have to be high-calibre graduates. The same Report shows that in the last decade, commercial air transport grew strongly due to the emergence of new commercial air transport operators and due to the largest number of aircraft orders ever recorded.

In the next 20 years the demand for licensed aviation personnel such as pilots, maintenance personnel and air traffic controllers should be correlated to aircraft delivery plans. This forecast is very important to enable proper training planning, creation of new training institutions or expansion of existing ones or to find effective means for the recognition of prior learning or validation of experience. By this recognition, we could shorten the period of training and save capacities.

Management and human resource development should ensure the continuous improvement of the level of competence of key personnel involved in safety, considering the interdependence between demand and supply of qualified personnel at national, regional and global levels. These elements require continuous training throughout their entire career adequate assessment tools to recognize the results of different stages of training and sometimes tools for the validation of experience. To answer this need, we are implementing the project “Knowledge Alliance in Air Transport” and we intend to develop a Methodology for Sectoral Qualifications Framework and recognition of prior learning and work experience in aviation. The core of this methodology is already presented in chapter eight.

As, we already view in chapter one, the aviation industry itself is a source of considerable economic activity, creating jobs that directly serve passengers at airlines, airports and air navigation services providers. This includes many categories of occupations: check-in, baggage handling, onsite retail, cargo and catering facilities. Moreover, aviation directly enables jobs in the manufacturing sector (those companies that produce aircraft, engines and other vital technologies) which also change when air transport change. For example, ground equipment changes on green energy and this change the demand of aviation to automotive and special equipment industries. The evolution of aviation’s global employment impact is presented in Fig 3.1 while the evolution of direct jobs by sectors is presented in Fig. 3.2 [71]

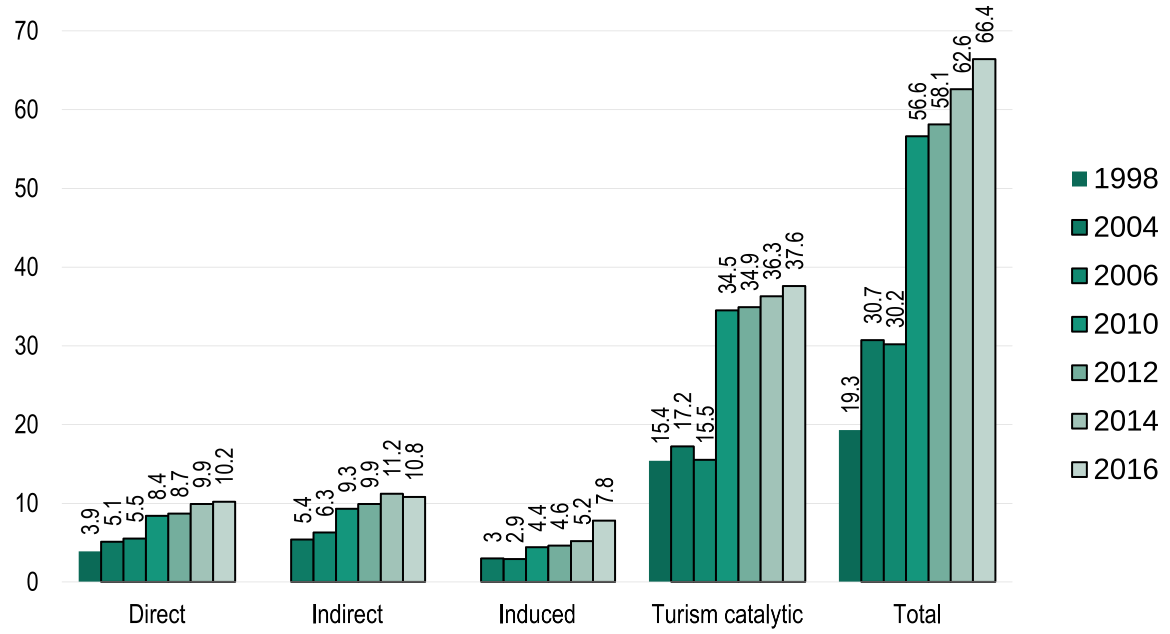

Figure 3.1 Aviation's global employment impact evolution
Source: [71]

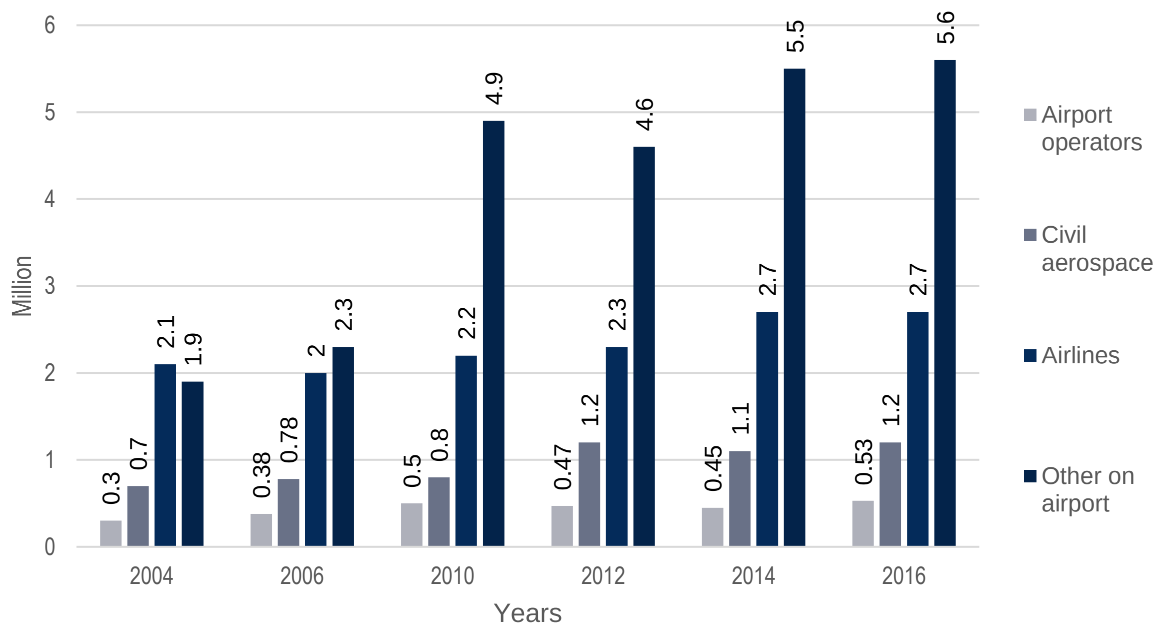

Figure 3.2 Evolution of direct jobs by sectors
Source: [71]

3.2 Education and Training for Air Transport

The air transport sector, while a highly regulated sector, includes very particular training institutions and comprises of a wide diversity of regulated occupations which involve specific training and award of licenses. Following the general rule, in aviation training programmes are distinguished by type, level and objectives of training. Hence, the need to determine very precisely the learning outcomes and to correlate them between the various training options and to bridge these training pathways. Recognition of competences and correlation of learning outcomes may provide support for designing coherent professional pathways and complementarity of general training in the aviation field, provided by high schools or universities and specific training for occupations in the sector.

Due to the strict requirements of the industry which is imposing the necessity of being licensed and certified in order to be able to work in such an environment, air transportation does not follow the usual educational pattern. The major question is to what extent are universities capable of providing competent graduates ready for direct insertion in this highly regulated field of work? The main pathways for education and training (fig. 3.3) are: on one hand, the academic one, which consists in Bachelor, Master and Doctorate study programmes, which can be followed by or can alternate with postgraduate trainings; and on the other hand the vocational pathway, ensured by various training providers, such as airlines, handling companies, regulatory bodies, private trainers, in compliance with European Aviation Safety Agency (EASA) and International Civil Aviation Organization (ICAO) regulations. The authors of this report are concerned with the creation of as many bridges as possible between the two pathways mentioned above.

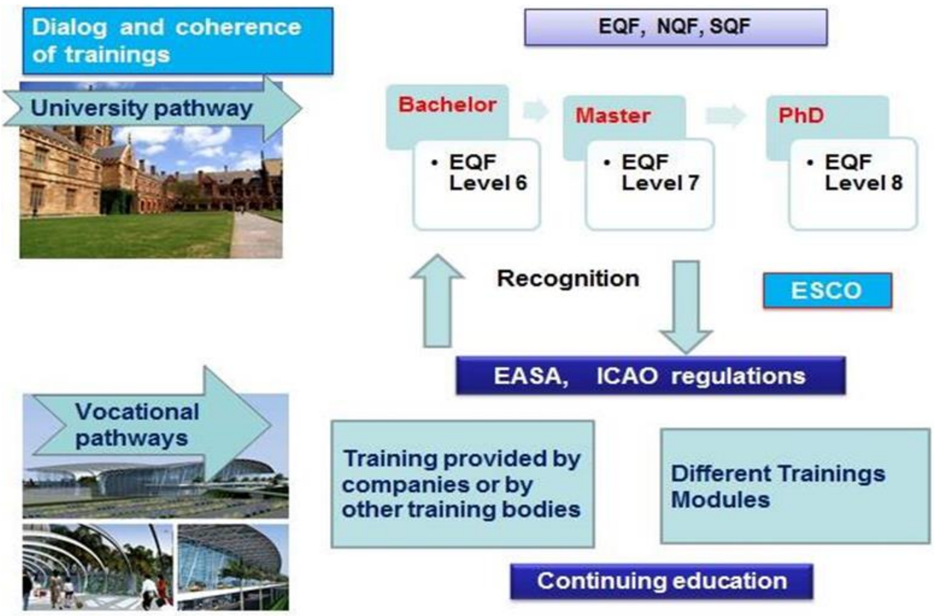

Figure 3.3 Pathways for training in air transport

In order to enhance coherence of training in the air transport industry, dialogue between university - trainer within the sector - employer is crucial for the joint development of tools defining learning outcomes for each training level, such as National Qualifications Framework (NQF), Sectoral Qualifications Framework (SQF) or other specific systems such as those used by Eurocontrol, Competence Based Assessment System (CBAS). The similarities of the two approaches, QF and CBAS consist in structure and descriptors of competences and in ways of achieving progression through qualifications levels. This theoretic attempt may be a first step towards highlighting the convergence between the two components, education and training, and it might lead to significant harmonization for the air transport field, as it serves as a very interesting example due to the international standards and requirements strictly supervised by the international aviation bodies [4].

In the air transport industry there are two staff categories: first, those who require specific competences certified by authorities in the field and acquired through special training programmes and the second category, those that do not require special training programmes such as the aerodrome management staff, which is not included in the regular licenced aeronautical staff. Annex 1 to the Chicago Convention[2] does not stipulate the requirement that this category of staff should be licensed, thus it is not usually included in national or international staff licensing regulations. Currently, each state uses its own practices for their training and appointment and there is no formal training process available, no formal training package in the aviation training schools. Subject-specific training courses are provided by different training organizations or even universities to enable the development of the professional skills for the aerodrome staff. Most people have attended and graduated, afterwards, additional training courses specialised on aerodromes [5].

In particular, the regulated programmes start with an initial training at high school or higher education level, study programmes which could have common learning outcomes and continue throughout the employee's professional life, according to their position and specific tasks. Due to this specificity, the development of a qualification's framework is crucial to ensure a coherent training pathway.

3.3 European Regulations regarding Qualifications Framework

The EC has developed tools as EQF, European Credit System for Vocational Education and Training (ECVET), European Credit Transfer and Accumulation System (ECTS), ESCO and the European Network of Information Centres - National Academic Recognition Information Centre (ENIC-NARIC) system to improve the match between the employer demand and the education and training provision within the recognition and validation of qualifications and learning outcomes.

The EQF is a common European reference framework acting as a translation device to make qualifications acquired within the different education and training systems in Europe more readable and understandable. It has two principal aims: to promote citizens' mobility between countries and sectors, and to facilitate their lifelong learning. Thanks to its overarching, integrative perspective and the learning outcomes approach, the EQF should: facilitate the transparency and comparability of qualifications and therefore their portability and transfer across countries, systems and sectors, make it easier for citizens to gain access to qualifications either though formal learning opportunities and/or fair validation of non-formal and informal learning [6]. At the same time, ICAO, EASA and EC deliver for the air transport sector, international or European regulations concerning the competence-based training and the skills demanded by regulated

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[2] Convention on Civil Aviation referto to as the Chicago Convention

occupations. So, in aviation, we deal on one hand with regulated or non-regulated international *qualifications* and on the other hand with both regulated and non-regulated *occupations* which must be very well correlated.

Aeronautical higher education institutions have a curriculum *which is not always in line with the* European Commission or EASA requirements stipulated in the regulations on maintenance, airworthiness of aircraft and of aeronautical products, and in the regulations on the approval of organizations and staff involved in these tasks. For these reasons, it is crucial to implement recognition tools for building bridges between the higher education and VET and furthermore to harmonise the international qualifications regulations elaborated by EASA and ICAO with the EQF and ESCO [7] tools. All these are vital for better employability and a better insertion of graduates on the aviation labour market, but also for facilitating mobility for occupational purposes in Europe.

The international implication at all levels in this industry has become intrinsic, thus the human resources involved in this area of activity should be highly qualified and adaptable enough to work in a highly competitive interdisciplinary and multicultural environment, capable to adapt in a field that it is in a continuous evolution. Being constantly up to date is a basic requirement for those involved in this industry. Therefore, it is essential to re-design and improve, correlate and harmonize the learning programmes and curricula with the industry's requirements. This highlights the importance of providing globally harmonised and compatible qualifications in this field and most importantly the focus should be on competence-based educational programmes delivered in a student-centred approach.

The complexity of the field requires high levels of both technical and managerial skills in some occupations such as aerospace engineer or airport manager. In others, such as air traffic controller, a set of very specific skills is required. Either way, it is paramount to find the best solutions to ensure the most adequate training possible. The first step consists in defining the competences needed in this field by training and education providers together with all stakeholders of the sector at international level. This might imply the building of an *European alliance of training providers and employers in order to establish the main education strategies in the sector.* The range of competences required by this field is very diverse and the key question is to what extent universities can adapt their training programmes in order to provide the air transportation labour market highly qualified personnel, as required by a very strictly regulated industry. This background highlights the importance of providing globally harmonised and compatible qualifications in the field of air transportation in the context of the Lisbon Strategy, and if in the Bologna Process, respectively. Therefore, strong partnerships between public authorities, higher education institutions, students, employers and employees need to be developed and maintained. The quality of the educational processes depends on this dialogue, the most important instrument for accurate definition and development of competence-based educational programmes [8].

In this context, we identified **two main needs** in terms of human resource training: the need for better qualified workforce especially with multidisciplinary competences for the new occupations in aviation, for example aviation-specific competences with IT or environmental skills, and the need for curricula modernisation simultaneously with the implementation of innovative and multidisciplinary approaches on education and trainings in aviation.

According to this air transport labour market demand, we propose two study programmes at master level: "IT Applied in Aviation" and "Smart, Green and Integrated Transport and Logistics". The two new study programmes are described in Chapter 9 in terms of learning outcomes.

3.4 The Role of "Knowledge Alliance in Air Transport" Project in Air Transport Education and Training

The air transport industry has a very 'mobile' labour market and is increasingly relying more and more on higher skill levels and transversal competences. Consequently, the educational programmes should equip students with the advanced knowledge, skills and attitudes, in a single word, competences they need throughout their professional lives to maximize their access to the opportunities in the ever-changing labour markets of air transport industry.

The goal of the project is to provide the air transport labour market with skilled and competent workforce through close cooperation between governments, higher education institutions, major industry employers, civil aviation regulators and students. Knowledge Alliance in Air Transport (KAAT) Project will implement a coherent and comprehensive set of interconnected activities which are flexible and adaptable to future contexts and developments of air transport across Europe. Within KAAT Project, we will boost innovation in higher education dedicated to air transport by introducing new innovative study programmes at Bachelor and Master level with a flexible learning pathway in order to ensure the high-calibre graduates with new key skills demanded, to increase the number of trainees and of maintenance training providers. The new learning pathway will take in consideration the intersections and the complementarity of HE and VET in order to enable mutual recognition and to sustain well-structured continuous training, without overlaps, ensuring the key skills necessary for aviation occupations.

4 Smart Qualifications for Smart Occupations

This section focuses on the changes affecting the air transport industry (discussed in chapter one) and aims to identify new qualifications needed to meet new trends and challenges in air transport. In the context of the current technological, socio-economic, political and demographic variations which are expected to have major impact on aviation jobs, future occupations will require new skills and knowledge. Thus, emerging jobs will imply continuous education, training and qualification, which will transform the air transport system.

A political driver of change for the aviation industry might be mirrored in the increasing influence of alternative regional and global institutions. However, concerns in the future regard the supply outstrip demand or how will global economy and the level of integration along air industry supply chain will affect the aviation industry. One possible approach will consider a shift to a knowledge-based economy.

In the next 20 years, the alternative energy sources have the potential to complete transform businesses, impact the development of sustainable aviation and affect government policies and public attitudes. But, one important concern refers to the impact of big data and how transparency and predictive analytics will influence both marketing and branding. It will also be important to know how much privacy passengers will be willing to give up in return for convenience, economic benefit and security. Data breaches and cyberattacks may require new tools and measures to protect data. Data privacy itself could become a valuable commodity, so, international regulations will aim to eliminate tensions regarding passengers' data privacy.

The impact of new technologies, robotics and automation, new manufacturing techniques or aircraft designs will transform the working conditions, shifting human potential and changing the skills that employers will be required to have. These new interdisciplinary skills for the jobs needed soon in the aeronautical field will not replace the existing ones; they will be required in addition to the current ones. And, although future occupations may have high automation potential, new qualifications and jobs related to digitization or digital transformation will consider necessary competencies such as people management and decision-making.

Skilled persons for new jobs within new departments will be needed. So, skills related to problem solving, critical thinking and creativity will be required in interdisciplinary qualifications, such as: ICT and aviation, economics and aviation, marketing specialists for air transport, green energy and air transport infrastructure, management for air transport or for multimodal transport.

4.1 Identifying Drivers of Change

New challenges are always on the horizon. Change can be sudden and overwhelming, or gradual and unnoticed; in either case the result can be difficult to manage. Innovative technology is often a source of disruption. But other drivers of change can come from social, economic and environmental factors and the regulation and policies designed to address these factors [33].

This means that in the future, new types of jobs in aviation need to be created. However unpredictable the future might be, there are ways to prepare for the challenges that might arise. In this context, the analysis of future trends aims to envision the way the future might unfold. Therefore, the aviation industry should constantly prepare for future trends and opportunities over the following 20 years.

International Air Transport Association (IATA) conducted a series of interviews with domain experts and global trend specialists. It also performed research and led workshops with over 50 senior airline representatives. This way, IATA identified a list of drivers of change (see Table 4.1.) that would have a significant impact on the aviation industry out to 2035.

The horizon scan was undertaken using a ‘STEEP' framework (Society, Technology, Economics, Environment, Politics – see Table 4.1.). Conclusions from the interviews and some points mentioned in the literature lead to a list of 50 drivers of change [33]. The scenarios were developed for the industry out to 2035. The next years are likely to be more turbulent, as a new flow of technological change and innovation evolves. Some consider that these changes might sweep the industry away. And technology is not the only source of disruption.

Among the drivers of change outlined in Table 4.1., some of the drivers are assessed to have a greater than average impact (and uncertainty). The 13 factors are unequally split between environment (four: International regulation of emissions and noise pollution, Environmental activism, Extreme weather events and Infectious disease and pandemics), society (three: New modes of consumption, Terrorism and Tensions between data privacy and surveillance) economy (thee: Oil price, Strength and volatility of the global economy and Level of Integration along air-industry supply chain), technology (two: Cybersecurity and Alternative fuels and energy sources) and politics (Geopolitical (in)stability). The 13 drivers of change are detailed in the following paragraphs indicating their potential to impact or disrupt communities, affect marketing strategies, shape prices over the next 20 years or destabilize aviation industry.

International regulation of emissions and noise pollution. It is known that aviation's contribution to overall CO2 emissions represents a marginal percentage compared to other transport sectors. However, the forecasts for 2050 vary in opinions. In the light of the above stated regarding emissions and noise pollution, it will be imperative to track if standards such as the ICAO CO2 emissions standard (along with technology, operational and infrastructure improvements) will be sufficient to meet international ambitions. On the other hand, the role of the media, of politics and public perceptions played in the future will be important, as air travel could become conspicuous in a more sustainable world [33, p8]..

Environmental activism. Environmental activism comes from directions such as: the public, the workforce, or even governments. Generational and societal shifts may lead to new tools – younger people are more likely to participate in online activism than older generations – while technology and cyber activism provide new opportunities and threats. In the future, activists might take a more militant stance through provocative marketing strategies [33, p8].

Table 4.1 Drivers of change for the aviation industry

Society	• Terrorism • Urbanization and the growth of megacities • Passenger identity and fraud • Global aging • Middle class growth in China and the Asia Pacific region • New modes of consumption • Tensions between data privacy and surveillance • Global population growth driven by Asia and Africa • Shifting ethnic, political and religious identity • Disability
Technology	• Cybersecurity • Expanding human potential • Robotics and automation • 3D Printing and new manufacturing techniques • Virtual and augmented reality • Internet of Things • Alternative fuels and energy sources • New aircraft designs • Alternative modes of rapid transit • Geospatial technology
Environment	• International regulation of emissions and noise pollution • Resource nationalism • Personal carbon quotas • Water and food security • Environmental activism • Extreme weather events • Rising sea levels and reclaimed habitats • Human-controlled weather • Circular economy • Infectious disease and pandemics
Economy	• Global income inequalities • Strength and volatility of global economy • Price of oil • Level of integration along air industry supply chain • Shift to knowledge-based economy • Privatization of infrastructure • Concentration of wealth into a “Barbell economy” • Unionization of labour and regional independence • Open data and radical transparency • Changing nature of work and competition for talent
Politics	• Bribery and corruption • Geopolitical (in)stability • Government ownership of airspace and critical infrastructure • Strength of governance • Anti-competitive decisions • Defence priorities dominate civilian needs • Shifting borders, boundaries and sovereignty • Increasing influence of alternative regional and global institutions • Trade protection and open borders • Rise of populist movements

(Source: [33] pg. 6

Extreme weather events. Extreme weather events (for example extreme temperature, snowfall or storms) are expected to increase in the future in frequency but also in severity. These events are driven by global problems caused mainly by pollution and reflected in climate change. In this situation, it is important to track the way the industry will react and adapt. Authorities must predict extreme weather; since an increasing frequency of this type of events might damage infrastructure or disrupt activities.

Infectious disease and pandemics. Sixty years ago, infectious diseases and pandemics were thought to be under control, but new threats such as SARS, Zika virus and animal diseases (e.g. BSE) have changed the situation. Future risks could impose a barrier in the desire and freedom to travel and will represent a significant (economic) challenge for aviation. However, new technologies will help detect and cure diseases.

New modes of consumption. Consumers throughout the world have been seeking greater value from products and services, redefining their relationship with ‘things’. The concept of access over ownership has changed as sharing models grow and thrive. Already, a backlash against one-size fits all technology, increased demands for authenticity and personalized experiences, sustainable consumption and desire for face-to-face interaction is starting to be outlined. But, the most important concerns of the future regard how will big data, transparency and predictive analytics influence marketing and branding.

Terrorism. Since terrorists can adapt fast to the techniques used by the counter-terror agencies and intelligence organizations, aviation requires the development of an effective comprehensive framework so that regulators, operators and others work together based on a collaborative approach. New technologies will lead to a shift from state-supported political terrorism towards diverse, transnational networks. The states that have a poor governance, ethnic, cultural, or religious tensions, weak economies and borders have represented a solid ground for terrorism; but now, one knows the source of tomorrow’s threats and their characteristics: if they will they be virtual or physical.

Tensions between data privacy and surveillance. Advances in connectivity and sensor networks are likely to empower citizens by providing real-time accountability and transparency. At the same time, privacy and surveillance are likely to be high on the list of military and government concerns over the next two decades. It will be important to know how much privacy people will be willing to give up in return for convenience, economic benefit and security. For corporations, data breaches and cybercrime may require new measures to protect data; privacy itself could become a valuable commodity.

Oil price. The price of oil has remained stable in the last years, since the oil prices have fell precipitously in 2014. But the future outlook is uncertain, and concerns regard the supply outstrip demand, but also how will geopolitics shape the prices in the next 30 years. It is important to understand that initially, low prices may drive cost savings for air transportation, but it is also important to see the global economic impacts.

Strength and volatility of global economy. Instability and turbulence in financial markets has characterized much of the 21st century and may continue. Economic shifts from West to East and an increase in South-South trade are likely to have a significant impact on international politics and governance, as well as other trends such as increasing inequality. As the economic influence of developing nations increases, new markets, competitors and demands will alter patterns of trade, changing what goods are transported where.

Level of integration along air-industry supply chain. An integrated supply chain allows manufacturers to investigate business processes across multiple suppliers and disparate platforms to follow materials, components and people wherever they are. The importance of emerging markets, economic growth and the appetite of developing countries for natural resources may boost global prices and make it trickier to configure supply chain assets. In this concern, it will be important to show how the supply chain will look like and how will it handle increasing complexity and demand volatility.

Cybersecurity. The threat of cybersecurity is growing with the development of new technologies (such as internet), becoming a major concern for businesses using technology. In the future, increased connectivity between real-world devices including aircrafts, airports and robots will make the boundaries between virtual and physical security blurred. As skills and knowledge develop, cybercrime could become a tool of activists, companies and governments, or a just a great challenge for hackers and terrorists.

Alternative fuels and energy sources. Alternative fuels and other energy sources have the potential to affect the geopolitical balance of power and the way businesses and the public consume energy. In the aviation industry, traditional fuels may be replaced by energy sources (such as bioenergy or fuel cells). Advances in energy storage will favour the development of renewables at a global stage. A thorough analysis of alternative fuels will reveal how climate change and sustainability will affect government and public position.

Geopolitical (in)stability. Nowadays, one in four people on the planet lives in fragile and conflict-affected areas. The actors in these conflicts include acts of violence and terrorism. Over the following years, religious and ethnic aspects, state fragility and the problem of global resources will indicate the basis of conflict, whether is fought on the ground, in cyberspace, or other new arenas. In this time, the stable parts of the globe could be affected and destabilized by populism, and nationalist movements will cover the entire international stage.

4.2 The Need for High Qualified Work Force

Air transport, as an integrating part of the world's largest industry, travel and tourism, provides $ 2.7 trillion economic benefit and employs 62.7 million people globally, predicting 99 million jobs by 2034 [8].

As the air transport sector currently undergoes a dynamic transformation and provides a wide diversity of regulated occupations, continuous education and specialized training for employees must be supplied, opening the door for high-level jobs based on interdisciplinary qualifications and driving long-term, sustainable economic growth. Since the aviation industry promotes education, ICAO's Next Generation of Aviation Professionals (NGAP) program offers guarantees that qualified professionals will maintain air transport system going forward [42].

Keeping in mind the previously analysed drivers of change, the following aspects should be considered while analysing the need for high qualified work force: economy, values and communities, technology and environment.

The evolution of the global economy and business models. The strength of the global economy is an important theme. The continued crises and unpredictability in economic growth will have direct impacts on fuel costs and in future investments. Since in the last years the price of oil was the driver with the highest impact and uncertainty, alternative fuels used in the aviation industry could be limited in the following the 20-30 years, especially if the low price of oil reflects into little stimulus to innovate; on the other hand, instability in oil producing countries may result in greater innovation. On the other hand, considering the business models of airlines we might see integration on the market and transformation of airlines in commodity suppliers. Future business models will have to clarify the distribution of non-aeronautical revenues between airports and airlines and if sharing economy business models or new technologies facilitating alternative (international) point-to-point travel will disrupt the industry.

Values and communities. As the new generations enter the scene, the aviation customers diversify and therefore attitudes are likely to change. Thus, air travel becomes more social due to intergenerational divides. Possible issues include mobility and health problems, the growing need of entertainment and connectivity, dietary requirements, language barriers. Future travellers might be more budget conscious; demanding higher sustainability or transparency in their interactions with the airline, airport, agencies, etc.

Technology. The airline industry can be considered a leader in applying new technology. The existing airline business models may change due to alternative modes of transport and technologies such as big data, data transparency and quantum computing. From a different point of view, there are some technologies that may reduce the need to physically travel between different locations on the map. For short and medium distances, new modes of rapid transport (e.g. hyperloop) will surely have an influence in the way people and goods travel. Moreover, technology could affect existing supply chains and the life-cycle of aircraft.

Environment. As stated previously, recognizing the impact of aviation on climate change (that slightly grows every year), means awareness and concern for the CO2 emission levels. The increased pressure on preserving the resources of water, food etc., mirrors in changing the attitudes of people and the regulatory frameworks. All actors in aviation should engage with this issue in the short, medium and long term, knowing that alternative modes of energy or new technologies are relevant and represent the future of aviation.

Conclusions

To consider the future of a major economic sector (i.e. aviation)– which in addition provides vital connecting infrastructure for a large share of the world's population – is a big and important task. The current report is based on a wide documentation in order to identify various factors and forces (called 'drivers of change'). These drivers of change need to be considered when taking decisions that shape the future of the airline industry and, directly or indirectly, the employees in the industry and the passengers that depend on it. Different studies performed by international air transport organizations have laid out important scenarios that the industry may face in the following 20 years.

In order to create these, the industry will have had to construct – using the drivers of change and many hypotheses – how the world may have changed between now and then. The scenarios are helpful in providing a sense of the scale of the changes that will occur. For sure, 2035 will be very different from today. With the help of IATA and more specifically the members of the Industry Affairs Committee, an initial set of implications of these drivers of change and scenarios for the airline sector were identified, and based on these, some recommendations were set out [33, p 46].

As an industry-level organisation, IATA and ICAO's role is (among others) to look at the ways individual organizations are exposed to changes in their internal or external environment. Some factors are important for a company; some changes will be important for one part of the industry supply chain; or for one region and less for another. Analysing and using the scenarios of change is useful to consider the future of businesses.

Organization need to make changes in order to be better prepared for incorporating these findings in plans and in their improved strategies. The importance of this report is that is shows how these actors must consider getting people from different parts of the organisation involved in this thinking; either it means suppliers or customers. For the industry, these perspectives must be built into its strategic planning process.

The material in this report provides some guidance, but more importantly it will catalyse new ideas. Surely, new drivers of change, new jobs and skills will enter the scene, so the perspective of the future of aviation is not complete.

4.3 Questionnaire on New Occupations and Qualifications (Annex 3)

This Report on KAAT Occupational Analysis in Air Transport Survey [34] has provided an analysis of the occupations in the aviation sector. The main outcomes of the analysis were the competences framework and the sectorial breakdown of current and emerging occupations.

To obtain information on current and emerging occupations and to consolidate the sectorial breakdown for the aviation sector, an online survey was developed for collecting feedback from various employees working in the aviation sector. The participants were asked to share their experiences and views regarding (a) the skills and competences required in their current occupations; (b) the emerging skills and competencies necessary for the future workforce; and (c) the past and present training and collaboration opportunities between industries and educational institutions.

The survey was structured around five main sections:

1. **Background and employment** (Q1 – Q8). The first section contained general questions about the background and employment of the respondents including age, gender, country and area of the aviation sector in which they currently work, as well as information about what they like the most and the least about their job.
2. **Education and training** (Q9 – Q18). The second section included questions related to the educational qualifications of the respondents and the training they have received within their organisation.
3. **Collaboration with educational institutions and training providers** (Q19 – Q23). As the KAAT project aims to bridge the gap between the vocational and academic educational pathways by fostering new university-business collaborations, this third section was included to explore the respondents' views regarding the synergies and collaborations between educational institutions and industry.
4. **Key competences** (Q24 – Q28). This section collected feedback on the competences needed in the aviation sector and validated key competences identified within WP1 that were included in the competences framework for the aviation sector developed as part of this work.

5. **New and emerging occupations** (Q29 – Q31). This last section explored respondents' views regarding the changing nature of work in the next years: the occupations that are going to disappear and those that will be created.

The survey was uploaded in the platform SurveyMonkey (www.surveymonkey.com) and the data analysed and reported refers to a period of three months, from 15.05.18 to 31.07.18.

The survey questions were developed based on the project scope, the identified list of occupations and their descriptions, and additional information required for the development of the mapping between occupations and qualifications. As such, the questions helped to further explore and validate the described occupations and understand how well the skills are required for them aligned with the learning outcomes of undertaken qualifications and training. The questions were generated based on the review of several external sources, current and past projects, and review of the questions by KAAT project partners. A copy of the KAAT survey is provided in Annex 3.

The online survey conclusions and the input obtained from the workshop participants were used as main sources for identifying the changing and displacing occupations as well as the emerging ones. Figure 4.1 shows some of the occupations that are going to drastically change or disappear. As indicated by the respondents to the survey, Air Traffic Controllers, Pilots, Cabin crew, Check – in agents or Ramp handing operators are some of the occupations that will be drastically affected by the technological transformations.

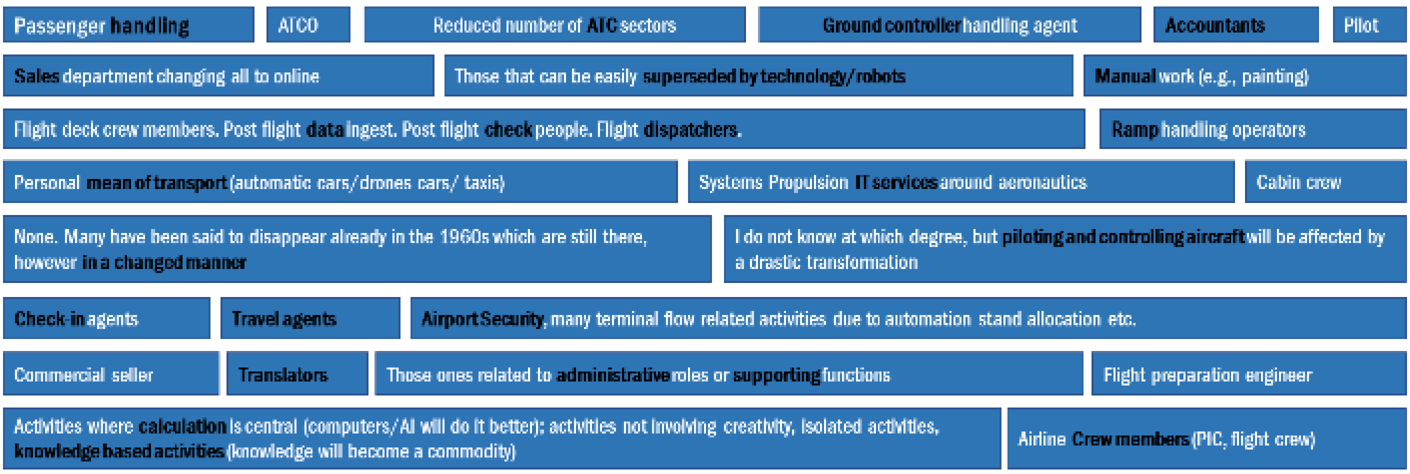

Figure 4.1 Which occupations do you think are going to drastically change or disappear by 2030?
Source [34]

4.4 Smart Qualifications

4.4.1 The Future of Jobs and Skills

Changes in aviation business models will have a profound impact on the employment over the coming years. Many of the major drivers of transformation that are now affecting the industry are expected to have a huge impact on jobs, (ranging from significant job creation to job displacement), and from heightened labour productivity to widening skills gaps. The future most in-demand occupations or specialties in aviation did not exist in the past and the pace of change is set to accelerate.

By one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that don't yet exist. In such a rapidly evolving employment landscape, the ability to anticipate and prepare for future skills requirements, job content and the aggregate effect on employment is increasingly critical for businesses, governments and individuals in order to fully seize the opportunities presented by these trends—and to mitigate undesirable outcomes [37].

Past waves of technological advancement have led to increased prosperity, productivity and job creation. This does not mean, however, that these transitions were free of risk or difficulty. Anticipating and preparing for the current transition is therefore critical. The future of occupations in aviation aims to bring specificity to the upcoming disruptions to the employment and skills landscape in the industry and to stimulate deeper thinking about how business can manage this change [6].

The research on new skills and new occupations in aviation must consider the opinions of leading experts from academia, international organizations, professional service firms and the heads of human resources of aviation organizations. This research on smart occupations seeks to understand the current and future impact of key disruptions on employment levels, skill sets and recruitment patterns in the industry. The industry must consider adaptive action today, rather than merely speculate on future risks and opportunities.

While the implications of current disruptions to business models for jobs are far-reaching, even daunting, rapid adjustment to the new reality and its opportunities is possible, provided there is concerted effort by all stakeholders. By evaluating the future labour market from the perspective of some of the world's largest employers in aviation, the current stock of knowledge around anticipated skills needs, recruitment patterns and occupational requirements will be improved. Furthermore, this knowledge can incentivize and enhance partnerships between governments, educators, training providers, workers and employers in order to better manage the transformative impact on employment, skills and education [37].

4.4.2 Need for Interdisciplinary Qualifications (Study Programs)

The world is becoming increasingly immersed with game changing digital technologies such as AI; with computer science playing a central role. Yet there are only a handful of countries where computer science is integrated into the mandatory pre-college curriculum. The future of the aviation labour market is far from a black hole. It's almost certain; there will be less jobs involving physical, routine or repetitive tasks; whereas jobs related to computer science (e.g. programming, data science, machine learning, robotics, cryptography) will be high in demand.

Faced with the challenges in aviation created by scarcity of resources, climate change, traffic management, technological developments and more, there is a need for new ways of thinking and new ideas. This must be achieved through innovation, smart solutions and technologies, resilience, flexibility, and future functionality which are the grounds of new qualifications across the world.

New approaches and ideas across disciplines are useful for smarter solutions. The range of smart solution are related to the aviation industry regarding air transport, intramodality, planning, IT solutions, the environment. The smart solutions contribute to 25% of the revenue growth by digital and new innovations.

The aviation sector is predicted to grow in a continuous way in the coming years. And with new technology entering the industry, there will be a great demand for aviation job training to fill the jobs in all sectors. Studies show that the aviation industry will need 34,000 new aircrafts by 203o. Also, by that year, 36 million new aviation-related jobs will be needed and created. But, meeting the demand for skilled professionals will not be such an easy task. The companies will only achieve growth through well-trained and talented employees, to meet the challenges of today and tomorrow and realize the potential of the next years.

Whilst it's unlikely for Artificial Intelligence (AI) to put the 63 million jobs in aviation at risk; quite likely, it will have a significant impact on the future skills demand and the composition of job types. So, the question that arises is 'What skills will be in demand next"? Future visions often have an enhanced value proposition; i.e. it's not only about more efficient ways of doing the same thing, but also radical change in how we achieve our end-goal. It's not only about replacing the baggage handler with a robot; but rather completely rethink the way valuable items of passengers are transported; with focus on doing it faster, and more reliable. In other words, the whole value proposition is revisited which in many cases leads to the creation of new jobs. Real-time operational, tactical and strategic optimization, distributed data exchange, and machine learning are things we haven't seen yet; and therefore the aviation value chain would need people in new roles to orchestrate these activities.

4.4.3 Example of Future Jobs - Innovation Leader

Innovation leaders will drive and facilitate the innovation process for business aviation. It enables growth through delivering innovative solutions, generating new sources of revenue and profits from innovations, leveraging the internal and external ideas and capabilities. It will drive and facilitate (digital) innovation and improve the organisation's innovative capability.

A strong drive for digitalisation and innovation and a deep experience with facilitation techniques and approaches tailored to the innovation process is useful for organizations in a business to business environment. Understanding the trends in the aviation market, engineering, technology, internet of things, the impact of digitalisation on the industry, environment, but also in aviation consultancy.

4.4.4 Future of Airline Distribution and Payment

Three major programs are transforming the travel distribution and payment.

- Participate in pilots and the definition of new standards for the New Distribution Capability (NDC).
- ONE order will modernize the order management process
- NewGen ISS will facilitate the distribution and settlement of funds between travel agents and airlines

NDC (New Distribution Capability) will enable the travel industry to transform the way air products are retailed to corporations, leisure and business travellers, by addressing the industry's current distribution limitations: product differentiation and time-to-market, access to full and rich air content and finally, transparent shopping experience.

ONE Order aims to modernize the order management process in the airline industry. This industry-led initiative intends to replace the multiple and rigid booking, ticketing, delivery and accounting methods, using the data communications advances made possible by the implementation of the New Distribution Capability.

NewGen ISS will facilitate the distribution and settlement of funds between travel agents and airlines [33].

4.4.5 Cargo

In the last year, airlines transported 52 million metric tons of goods, representing more than 35% of global trade by value but less than 1% of world trade by volume. That is equivalent to $6.8 trillion worth of goods annually, or $18.6 billion worth of goods every day.

On average, cargo business generates 9% of airline revenues, representing more than twice the revenues from the first-class segment. To support this critical business, enhanced value for the industry will be achieved by driving a safe, secure, profitable and sustainable air cargo supply chain.

In this concern, the qualifications needed in air cargo promote greater efficiency in the supply chain involving transportation of dangerous goods/hazardous materials, perishables & pharma. The programs aim at transforming air cargo by implementing e-freight, ONE Record, Interactive Cargo, Smart Facility and Cargo Connect, by supporting border efficiency and trade facilitation [33].

4.4.6 Safety

With around 900,000 aircraft ULDs in service representing a replacement value of over USD $1 Billion, ULDs are expensive assets that require correct handling. ULDs are aircraft parts and directly contribute to flight safety. Every day, approximately 100,000 flights take to the sky and land without incident. Flying continues to be of tremendous importance to modern life and getting on an aircraft is among the safest activities. Safely connecting people and businesses continues to be a priority. Thus, airlines and industry partners are raising standards and implementing best practices. The qualifications needed in aviation regarding safety aspects identify organizational, operational and emerging issues [32].

4.4.7 Policy

Intensive lobbying campaigns aim at supporting many aspects of airline operations. Major policy initiatives include: passenger rights, emissions trading, security, aviation charges, airport slots, the benefits of aviation.

Air transport generates incredible social and economic benefits for a lot of different people, governments, national economies, large and small businesses, and travellers. The 'value of aviation' highlight these benefits and encourage governments to help air transport unleash its value.

It is important to regulate the industry in a harmonized way, facilitating the global aviation system that is so critical to modern life. The 'smarter regulations' are aimed at working with governments to drive this agenda forward. Some of the areas where there is a need for smarter regulation approach are consumer protection, unruly passengers, the management of airport take-off and landing slots, taxes on air transport and problems that airlines have in repatriating the money they make in overseas markets.

Smart regulations deliver clearly defined, measurable policy objectives in the least burdensome way. It is achieved through a transparent, objective, and consultative process.

Smart qualifications for smarter regulation (or better regulation initiatives) imply cutting unnecessary burdens on consumers and businesses. To actively apply these smarter regulation principles and reduce avoidable interference in the commercial and operational activities of airlines, smarter regulation initiative seeks to promote partnerships with governments that result in regulation that delivers clearly defined, measurable policy objectives in the least burdensome way.

4.4.8 Smart Security

The Industry Issue. Today's passenger and cabin baggage security screening works, but at a cost to authorities, to the airline industry and to passengers. Given the predicted growth in air travel, continuously evolving security threats and passengers being increasingly dissatisfied with queues and intrusive measures, the industry agrees that today's model is not sustainable in the long term.

The Vision. A continuous journey from curb to airside, where passengers proceed through security with minimal inconvenience, where security resources are allocated based on risk, and where airport facilities can be optimized.

The Solution. The vision will be achieved through the introduction of risk-based security concepts, advanced screening technologies, and process innovation. With these elements in combination, Smart Security seeks to deliver:

- **Strengthened security**– Focus resources based on risk, increase unpredictability, make better use of existing technologies, and introduce new technologies with advanced capabilities as they become available
- **Increased operational efficiency**– Increase throughput, optimize asset utilization, reduce cost per passenger, and maximize space and staff resources
- **Improved passenger experience**– Reduce queues and waiting times and use technology for less intrusive and time-consuming security screening

Smart Security is a vision for more effective and sustainable passenger screening. For airlines, this concept will increase customer satisfaction and reduce departure delays.

While the Smart Security program sets a vision for the longer term, many Smart Security concepts and solutions are available today. Over the past few years, they have been tested and evaluated in partnership with governments, airports, airlines, and solution providers. Airports, including Geneva, London Heathrow, Amsterdam Schiphol, London Gatwick and Melbourne, are amongst those leading the way, with many more now looking at how Smart Security concepts can be incorporated into their operations [33].

4.4.9 The Need for Interdisciplinary Qualifications (Study Programs) - Environment & Aviation

Building a greener future

Air transport is united behind a four-pillar environmental strategy and challenging targets to achieve carbon-neutral growth from 2020: improvements to technology, operations and infrastructure and the deployment of sustainable alternative fuels. This will improve environmental management and a carbon offset program will be available to airlines.

Evaluation systems are designed to independently assess and improve the environmental management of an airline based on principles in compliance with environmental obligations and a commitment to continually improve environmental management [41], [45].

4.4.10 The Need for Interdisciplinary Qualifications (Study Programs) - IT & Aviation

The amount of automation will increase

The industry predicts even more sophisticated smart technology - fully automated online systems, fully automated inspections and online monitoring systems whilst the aircraft is flying with feedback to the engineer.

For consumers it will speed up the inspection probability detection – getting flights off on time. Five or 10 years ago someone could have missed a minor defect but as technologies get better and better, the smallest defects are picked up even. Traditionally a full plane inspection can take 6-10 hours, but the technology is changing, and it will help to keep costs down and fly longer [9], [24], [28].

4.4.11 Air Travel Will Be a Seamless Experience

Travelling will become much more of a connected and seamless experience. Now, travelling it's about car reservations, it's about the time to leave to go to the airport, it's getting through the airport, getting on to a airplane, finding a good hotel, getting to the hotel, and so on.

To provide the passenger an improved experience, technology will come together at some point and the passenger will have the same experience while flying like the transportation on the ground. The future will provide a disruption in the different segments of the travel experience and bring it together in one platform.

Big data will Improve the Airport Experience

There's a lot of confident talk about harnessing the power of big data to make the passenger experience that bit easier. Passenger processing will certainly become a much smoother experience, with reduced bottlenecks at the security checkpoints for instance and at the boarding gate. That's the aim, but it will take some time. Smart use of big data could also help with the inflight experience for the passenger, and for retailers in terms of retail in duty free, tracking customer behaviour and all aspects of air travel [9].

Digital Design Will Change How Aircrafts Are Made

We are seeing step changes in engine architecture. Through digital design and that will go from strength to strength. That means designing digitally far more than we do now. The system could be the whole aircraft. If you really want to make step changes — performance of the engine or design — you don't have the luxury of iteration or incremental change. The focus from the industry partner is far greater digitization of design processes and far greater integration with rest of aircraft [9].

Digital Analytics Will Improve Airline Operations

The game changer in technology terms is the incredible promise held by digital analytics. It involves the deployment of knowledge more widely and more collaboratively; to understand fuel usage, aircraft routes and flight paths, air traffic control and the weather right through to managing an operator's engine inventory and helping them plan that inventory right through to the point of engine disposal, either to another operator or to retirement [9].

Security Processing Time Will Shorten

For the passengers, an improvement in the security of equipment and thus, a shorter time spend in the security check is expected. The improve time of testing will be improved considerably. Due to digital tools, the quality of test and supervision has got much faster and sophisticated. But the most important thing is that, continuity between production testing and maintenance testing will ensure a higher level of safety.

Big data will drive smarter operations

Advanced data analytics already is changing how airlines operate, making them more efficient and driving down costs. Every day, Boeing customers use our tools to monitor 3,200 airplanes in flight for predictive maintenance information to avoid delays and disruptions. The customers use Boeing's analytics-based decision engines to reduce crew-scheduling costs by as much as 7%, reduce engine maintenance costs by 10-15%, and to conserve hundreds of pound of fuel on every flight. Every part of an airline's operation — from managing inventory to serving passengers — is benefiting from advanced analytics [9].

Aviation Skills Mismatch

An optimistic future view would argue that the number of newly created jobs will always exceed, or at least, be equal to the ones that are made redundant. Whilst that may be true; there will be a significant skills shortage and gap. It wouldn't be realistic to expect a smooth transition from being a pilot, cabin crew, ground handler; to being a data scientist, machine learning expert.

If the next generation is to use Artificial Intelligence and big data effectively – if they're to understand their inherent limitations and build even better platforms and intelligent systems — we need to prepare them now. That will mean some adjustments in elementary education and some major, long-overdue upgrades in computer science instruction at the secondary level.

We would need to have an education and training strategy in place to properly equip the next generation; otherwise we will end up with lots of new jobs, and lots of unemployed candidates unable to do them.

Conclusions

New qualifications and jobs especially related to digitization are needed. Digital transformation requires a coherent professional pathway founded on a set of demands and skills that don't follow the general education and training process in aviation. Specific demands and competences need to be tackled collaboratively by the industry and regulatory authorities, implying the ability to deal with complex knowledge and problem solving in ICT. The challenge of creating new types of jobs demanded by digital transformation is to anticipate and prepare for future skills requirements, to share a common expertise and create a safety net for employees [73].

The research on new skills for smart occupations must consider the opinions of experts from both academia and aviation organizations and outline the need for interdisciplinary qualifications. Thus, study programs must focus on interdisciplinarity (for example IT & Aviation) since the industry predicts more smart technologies and smarter operations. In this respect, education and training strategies must be applied by universities and training institutions for preparing the next generation of aviation employees.

It is very important to ensure the skilled persons for new jobs within the new departments. Personnel with interdisciplinary skills is need, for example: ICT and aviation, economics and aviation, marketing specialists for air transport, green energy and air transport infrastructure, management for air transport or for multimodal transport.

Examples of interdisciplinary qualifications can be found at the Engineering and Aeronautical Management master program at the Faculty of Aerospace Engineering, or the UNESCO Chair's Smart, Green and Integrated Transport and Logistics/ Sustainable Transport master program, both at Politehnica University in Bucharest, but also the KAAT Erasmus project which will also be completed with a master program: IT applied in aviation.

For the jobs needed in the near future in the aeronautical field, although they may have a high automation potential, competencies such as people management, complex problem solving and decision-making will be imperative [24] ,[60], [61], [74].

5 Regulatory Framework

This chapter focuses on the regulatory framework in the EU concerning the qualifications and employment, more specifically the European Qualifications Framework (EQF) and skills anticipation (section 5.1), regulation on air transport, including aircraft maintenance, air traffic control, air crew regulations (section 5.2) and some of the international civil aviation regulations section (5.3).

5.1 European Commission Regulations on Qualification and Employment

5.1.1 European Qualifications Framework (EQF) - A Bridge between National Qualifications Systems

One of the important tools in the development of qualifications and mobility of workforce in EU is the European Qualifications Framework (EQF), which is a common European reference framework whose purpose is to make qualifications more readable and understandable across different countries and systems. Covering qualifications at all levels and in all sub-systems of education and training, the EQF provides a comprehensive overview over qualifications in the 39 European countries currently involved in its implementation.

The core of the EQF is its eight reference levels defined in terms of learning outcomes, i.e. knowledge, skills and autonomy-responsibility. Learning outcomes express what individuals know, understand and are able to do at the end of a learning process. Countries develop national qualifications frameworks (NQFs) to implement the EQF.

Since its inception in 2008, the European Qualifications Framework (EQF) has been the common reference tool bringing European countries' NQFs together. The implementation of the EQF was based on the Recommendation on the European Qualifications Framework for lifelong learning adopted by the European Parliament and the Council on 23 April 2008. Reflecting the success in implementing the 2008 recommendation, a revised and strengthened Recommendation on the EQF was adopted on 22nd May 2017 by the Education, Youth, Culture and Sport Council. The purpose of this revised recommendation is to ensure the continuity as well as a further deepening of the EQF. The recently revised EQF Council recommendation [26] encourages the trend towards comprehensive frameworks which include qualifications of all types and levels, awarded by different bodies and subsystems. It also addresses the question of their impact, stressing the need to make their contribution to lifelong learning, employability, mobility and social integration more visible to end-users.

5.1.2 NQFs Development and Implementation

In close cooperation with the European Commission, CEDEFOP provides analytical and coordination support for the implementation of the EQF and carries out several comparative studies and analysis on issues related to the implementation of the framework at EU, national and sectoral level.

Thanks to the dynamic progress of NQF development, several national frameworks now provide comprehensive 'maps' of national qualifications and the relationships between them. This increased transparency across systems and borders helps promote mainstreaming and comparability of qualifications at European level. The time has come to assess the frameworks' impact from a European perspective and to look at their potential as facilitators of change.

CEDEFOP has regularly monitored NQF development since 2009 [31]. A total of 39 European countries are currently developing and implementing 43 NQFs, which have reached different stages [31]. Of these, 35 countries have formally adopted their NQFs (most recently Austria, Finland, Italy, Luxembourg, Poland and Slovenia). By the end of 2017, 34 countries had referenced their NQFs to the EQF, among which *Croatia, France, Italy, Portugal and Slovakia*. Further, 29 countries have linked their NQFs to the framework for qualifications in the European higher education area (QF-EHEA). The remaining countries are expected to follow soon. Ireland, Greece, Malta, Portugal and Romania have merged multiple qualifications bodies into single entities covering all qualification types and levels. It remains to be seen, however, if these reforms will lead to increased synergies.

CEDEFOP considers 21 NQFs to have reached operational status [13]. These have become an integrated part of national education and training systems and are fully based on learning outcomes. By involving a broad range of education, training and labour market stakeholders, the frameworks have provided a platform for dialogue and coordination across traditional institutional and sectoral borders in many countries.

One of the challenges for EFQ is represented by the international qualifications. In air transport, there are many international qualifications managed accordingly the EASA and ICAO regulations. The challenge is to make compatible the EQF and the regulations on sectorial qualification in air transport.

Based on EFQ, member states implemented the NQF. We present a summary of those NQF, using CEDEFOP data for the countries where the partners in this project belong: Croatia, France, Italy, Portugal, Romania, Slovakia.

5.1.2.1 National Qualification Framework in Croatia

The Croatian qualifications framework Act establishes the Croatian qualifications framework (CROQF) based on learning outcomes, defined in terms of knowledge, skills, and responsibility and autonomy (Croatian Ministry of Science, Education and Sports, 2013) [21]. It is a comprehensive **eight-level framework**, that also incorporates credit systems (Table 5.1.). It includes qualifications from all levels and subsystems of formal education and training: general education, VET and higher education. Each qualification in the CROQF is defined in terms of profile (field of work or study), reference level (complexity of acquired competences) and volume/workload (credit points). Apart from offering transparency and allowing for international comparability of Croatian qualifications, the CROQF is seen as an important tool for reforming national education and training; this includes setting up a system for validating and recognising non-formal and informal learning, creating a well-founded quality assurance system, and implementing the learning outcomes approach in all education and training subsystems.

The framework has entered an early operational stage, following adoption of the ordinance on the CROQF register in May 2014. Implementing structures have been set up and responsibilities among stakeholders agreed. The National Council for Development of Human Potential, comprising 24 stakeholders' representatives, was appointed in 2014 as the strategic body for developing and implementing the CROQF. On a policy and technical level, the Ministry of Science and Education coordinates the development and implementation of the CROQF, in close cooperation with the Ministry of

Labour and Pension System. 23 of 25 sectoral councils have been set up as advisory and professional bodies that assess proposals on occupational standards, qualifications standards and units of learning outcomes [22]. The information system of the CROQF register has been established. It is a system for registering and integrating occupational standards with qualifications standards through units of competences and units of learning outcomes. The first occupational standard is now publicly available in the register [22]. An ordinance on validation of prior learning is also foreseen, but it is still to be finalised. Croatia referenced the CROQF to the EQF and self-certified to QF-EHEA in March 2012 [23].

Table 5.1 Croatian national qualifications framework (CROQF)

CROQF levels	Qualification types	EQF levels
8.2	Doctoral diploma (poslijediplomski (sveučilišni) doktorski studiji; obrana doktorske disertacije izvan studija)	8
8.1	Postgraduate research master of science diploma (poslijediplomski znanstveni magistarski studiji)	
7	Master diploma – graduate university studies (sveučilišni diplomski studiji) Professional master diploma – specialist graduate professional studies (specijalistički diplomski stručni studiji) Post-master specialist university studies (poslijediplomski specijalistički studiji)	7
6	Bachelor diploma – undergraduate university studies (sveučilišni preddiplomski studiji) Professional bachelor diploma – undergraduate professional studies (stručni preddiplomski studiji)	6
5	Professional higher education diploma – short cycle (kratki stručni studiji) VET post-secondary development and training certificate (strukovno specijalističko usavršavanje i osposobljavanje) Master craftsman diploma (programi za majstore uz najmanje dvije godine vrednovanog radnog iskustva)	5
4.2	Upper secondary general education school leaving certificate (Gimnazijsko srednjoškolsko obrazovanje) Upper secondary VET certificate – four years / Upper secondary VET certificate – five years (Četverogodišnje i petogodišnje strukovno srednjoškolsko obrazovanje)	4
4.1	Upper secondary VET – three years (Trogodišnje strukovno obrazovanje)	
3	Upper secondary VET certificate – two years / Upper secondary VET certificate – one year (Jednogodišnje i dvogodišnje srednjoškolsko strukovno obrazovanje)	3
2	Vocational training certificate (Strukovno osposobljavanje)	2
1	Primary education certificate – eight years (Osnovno obrazovanje) (*)	1

Source: [12] [23] [21]

5.1.2.2 National Qualification Framework in France

France has an NQF based on a **five-level structure** which has been in use since 1969; its regulatory role is strong and well-established. The NQF was established in 2002, when the national commission on vocational qualifications (Commission nationale des certifications professionnelles, CNCP) and the national register of vocational qualifications (Répertoire national des certifications professionnelles, RNCP [55]) were set up. In scope, the French NQF is more limited compared to the comprehensive NQFs now being developed throughout Europe: as a framework with strong labour market focus, it does not include general education. It covers vocationally or professionally oriented qualifications, including all higher education qualifications with a vocational and professional orientation and purpose. However, an important characteristic of the CNCP lies in its openness to public and private providers and awarding institutions.

Three main types of qualification are included in the RNCP [55]: those awarded by French ministries in consultation with the social partners (these qualifications are included automatically); those awarded by training providers, chambers and ministries but where no consultative committee is in place; and those set up and awarded by social partners under their own responsibility. The latter two types of qualification are included in the register following approval by the CNCP and adherence to a set of strict procedures and criteria. Over 12 000 qualifications are currently covered by the framework, of which around two thirds are awarded by public authorities, and one third are issued by training providers, chambers and social partners.

The objectives of the French NQF are focused on employability, responding to the need for education and training to prepare candidates for the labour market. Recent policy initiatives and reforms underscore the high priority given to employability. A common policy on learning outcomes covers the entire vocational system, and all qualifications registered in the RNCP can be acquired through validation; in France this aims specifically at awarding an official, formal qualification. Belonging to the first generation of European frameworks, the French NQF is fully operational. The broad involvement of stakeholders captures the diversity of qualifications in France and ensures credibility and ownership.

CNCP is a platform for cooperation between ministries, social partners and other stakeholders. The French experience since 2002 illustrates the need for NQFs to evolve continuously to stay relevant. As the qualification system has developed considerably, and in view of addressing youth unemployment, two proposals have been put forward in recent years for a revised level structure and its descriptors: **one in 2012 for an eight-level structure, and one in 2016 for a seven-level structure** (Table 5.2.). One particular question that has been discussed was opening up the framework to low-level qualifications that would correspond to EQF level 2. However, this issue is politically sensitive as the current levels are linked to wider collective bargaining agreements. The French NQF was referenced to the EQF in 2010 [17]. NQF and EQF levels are included in databases as well as in certificate and diploma supplements.

Table 5.2 French national qualifications framework

French Nomenclature	Qualification types	EQF levels
I-Doctorat	Doctoral programmes (*Doctorats*)	8
I-Master	Master degrees (*Master*) Degrees in engineering (*titre d'ingénieur*) Qualifications on demand level I	7
II-Grade de Licence	Bachelor programmes (*Licences*) Vocational bachelor (*Licence professionnelle*) Qualifications on demand level II	6
III	Undergraduate technician certificates (*Brevet de technicien supérieur – BTS*) Undergraduate technician certificates in agriculture (*Brevet de technicien supérieur agricole – BTSA*) Undergraduate certificates in technology (*Diplôme universitaire de technologie – DUT*) Master qualifications issued by the chambers of trades (*Brevets de maîtrise – Chambre des métiers*) Qualifications on demand level III	5
IV	Vocational baccalaureates (*Baccalauréats professionnels*) Technological baccalaureates (*Baccalauréats technologiques*) Professional certificates (*Brevet professionnels*) Applied arts certificates (*Brevet des métiers d'art*) Technician certificates (*Brevet de technicien*) Qualifications on demand level IV	4
V	Secondary vocational certificates (*Certificat d'aptitude professionnelle – CAP; Brevet d'études professionnelles – BEP*) Secondary vocational certificates in agriculture (*Certificat d'aptitude professionnelle agricole – CAPA; Brevet d'études professionnelles agricoles – BEPA*) Qualifications on demand level V	3
	No French qualifications and certificates at these levels	2 1

Source: [12], [18]

5.1.2.3 National Qualification Framework in Italy

The Italian NQF was legally established in January **2018**, via an NQF decree, signed by the Ministry of Labour, the Ministry of Education, and the Regions and published in the Official Journal. It was the result of a lengthy process, involving a broad range of stakeholders; technical work and reforms have been carried out over the past decade. Since 2003, reforms have been implemented in upper secondary general education, VET and higher education, anticipating the principles of a learning-outcomes-based NQF.

The Italian qualifications framework for higher education (Quadro dei Titoli Italiani dell'Istruzione Superiore, QTI) was published in 2010 and self-certification to the QF-EHEA was completed in 2012 (Table 5.3.). Given the fragmentation of the education and training system and the complex model of governance in the country, the challenge has been to achieve effective inter-regional coordination and to integrate different education and training subsystems into a coherent national qualification system for lifelong learning. A comprehensive NQF, based on explicit levels of learning outcomes, will help with transparency and comparison between different qualification types awarded by different authorities, facilitate validation of non-formal and informal learning, and support adult participation in lifelong learning.

Table 5.3 Italian qualification framework

EQF levels	Italian formal qualifications
8	Research doctorate *(Dottorato di ricerca)* Academic diploma for research training *(Diploma accademico di formazione alla ricerca)* Specialisation diploma *(Diploma di specializzazione)* Second level university master *(Master universitario di secondo livello)* Academic specialisation diploma (II) *(Diploma accademico di specializzazione (II))* Higher specialisation diploma or master (II) *(Diploma di perfezionamento o Master (II))*
7	Master degree *(Laurea magistrale)* Second level academic diploma *(Diploma accademico di secondo livello)* First level university master *(Master universitario di primo livello)* Academic specialisation diploma (I) *(Diploma accademico di specializzazione)* Higher specialisation diploma or master (I) *(Diploma di perfezionamento o Master (I))*
6	Bachelor degree *(Laurea)* First level academic diploma *(Diploma accademico di primo livello)*
5	Higher technical education diploma *(Diploma di tecnico superiore)*
4	Professional technician diploma *(Diploma professionale di tecnico)* Upper secondary education diploma *(Licei diploma liceale)* Upper secondary education diploma – technical schools *(Diploma di istruzione tecnica)* Upper secondary education diploma – vocational schools *(Diploma di istruzione professionale)* Higher technical specialisation certificate *(Certificato di specializzazione tecnica superiore)*
3	Professional operator certificate *(Attestato di qualifica di operatore professionale)*
2	Compulsory education certificate *(Certificato delle competenze di base acquisite in esito all'assolvimento dell'obbligo di istruzione)*
1	Lower secondary school-leaving diploma *(Diploma di licenza conclusiva del primo ciclo di istruzione)*

Source: [12], [47]; [48]; [56]

Law 92/2012 on labour market reform was an important milestone in this work. It contains provisions on lifelong learning, and approaches to a national system of certification of competences and services for validation of non-formal and informal learning. In 2015, stakeholders reached agreement on an operational common framework for national recognition of regional qualifications and related skills – the national framework of regional qualifications – followed by an inter-ministerial decree. A national repertory of qualifications was established by Decree 13/2013 and comprises four different sections: higher education, secondary education, vocational education and training, and the national framework of regional qualifications. The latter two sections have been populated with qualifications and are available to consult online [50].

Italy has referenced its formal national qualifications (general education, VET and higher education qualifications), which are awarded by the Ministry of Education and University [46], and those awarded by the regions in the framework of the state-regions agreement, directly to the eight EQF levels, using the EQF level descriptors. The first referencing report was presented to the EQF advisory group in May 2013. Other qualifications awarded by the regions, licences for regulated professions and private qualifications, are not included and will be dealt with in the second stage of referencing.

5.1.2.4 National Qualification Framework in Portugal

A comprehensive NQF (***Quadro Nacional de Qualificações, QNQ***) has been in place since October **2010.** It is a single reference for classifying all levels and types of qualification obtainable in Portuguese education and training via formal, non-formal and informal learning. It has **eight levels** and is defined in terms of *knowledge, skills and attitudes* (Table 5.4.). The NQF has been part of a broader education and training reform programme since 2007, aiming to raise the low qualifications level of the Portuguese population. Its main objectives are to enhance integration between the different education and training subsystems, improve quality, relevance, transparency and comparability of Portuguese qualifications, along with their understanding abroad, and promote access to lifelong learning and recognition of knowledge and skills.

Table 5.4 Portuguese national qualifications framework (QNQ)

QNQ levels	Qualification types	EQF levels
8	Doctoral degree (*Doutoramento*)	8
7	Master degree (*Mestrado*)	7
6	Bachelor degree (*Licenciatura*)	6
5	Diploma in technological specialisation (*Diploma de Especialização Tecnológica*)	5
4	Upper secondary education and professional certification (*Ensino secundário obtido por percursos de dupla certificação*) Upper secondary education and professional internship – minimum six months (*Ensino secundário vocacionado para prosseguimento de estudos de nível superior acrescido de estágio profissional – mínimo de seis meses*)	4
3	Upper secondary general education school leaving certificate (*Ensino secundário vocacionado para prosseguimento de estudos de nível superior*)	3
2	Third cycle of basic education (*3º ciclo do ensino básico obtido no ensino regular*) Third cycle of basic education and professional certification (*3º ciclo do ensino básico obtido por percursos de dupla certificação*)	2
1	Second cycle of basic education (*2º ciclo do ensino básico*)	1

Source: [12], [52], [57], [59], [65]

The NQF has reached operational stage and is already considered a permanent feature of the national qualifications system. The legal framework is in place, qualifications have been assigned to levels, and quality assurance arrangements have been established. All VET is already organised around the NQF: qualifications databases consider the structure of the NQF and access to financial support also takes the framework into consideration. Most national qualifications certificates and diplomas indicate the corresponding NQF qualification level. Higher education qualifications have been included in the more detailed framework for higher education qualifications (FHEQ-Portugal), which is part of the comprehensive NQF.

The NQF has been a driving force behind incorporation of the learning outcomes approach into Portuguese education and training. National qualifications and curricula in all education sectors have been progressively aligned with the NQF descriptors, a challenging task that is continuing. There is still a need to encourage discussion and raise awareness on learning outcomes among different stakeholders and disseminate the information to a wide spectrum of stakeholders, especially in the labour market, where the NQF is not yet well-known. The NQF was linked to the EQF and self-certified against QF-EHEA in June 2011 [65].

5.1.2.5 National Qualification Framework in Romania

Romania adopted a learning-outcomes-based NQF for lifelong learning, the Romanian NQF (ROQF), in **2013**. This aims to bring together nationally recognised qualifications from both initial and continuing VET, apprenticeship, general and higher education, and help integrate the validation of non-formal learning into the national qualification system. The Romanian framework has **eight levels**, defined in terms *of knowledge, skills and competences* (Table 5.5.). Apart from its transparency function, the ROQF is seen as a tool to support national reforms and modernisation of education and training, opening up the possibility to address issues such as coherence and progression in the education system, the use of validation, adult participation, and transitions between work and education.

The framework builds on reform in VET and the development of competence-based qualifications since the mid-1990s. Parallel work was carried out in higher education, and a qualifications framework for higher education was established in line with the Bologna process and the EQF. One of the main challenges was to link the development processes, structures and stakeholders from VET and higher education and to improve links with the labour market. An important step was taken in June 2011 through the set-up of a single National Qualifications Authority – NQA (Autoritatea Naţională pentru Calificări, ANC [51]), responsible for developing and implementing the comprehensive NQF.

The ROQF is firmly based on national legislation and underpinned by a clear governance structure [54]. The strong role of the NQA as initiator of legislation and its human resource capacity are positive aspects. The framework is at an early operational stage; related legislation has been amended and supplemented regularly, and a new amendment is pending. Criteria and procedures for inclusion of qualifications into the ROQF and the methodologies for assigning qualifications to levels need to be clarified. Establishing good cooperation between different stakeholders and structures is essential for the ROQF to achieve its aims.

A draft EQF referencing report was presented in 2014 and the final referencing report is expected to be submitted to the EQF advisory group in 2018. The qualifications framework for higher education was self-certified against the QF-EHEA in 2011 [72].

Table 5.5 Romanian national qualifications framework (ROQF)

QNQ levels	Qualification types	EQF levels
8	Doctoral degree (*Diploma de doctor*) (third cycle of higher education) Certificate for postdoctoral studies (*Atestat de studii postdoctorale*) (postdoctoral studies)	8
7	Master degree (Diploma de master) and Diploma supplement (second cycle of higher education) Bachelor degree / Architect diploma (Diploma de licenta / Diploma de architect) and Diploma supplement (first and second cycle combined higher education study programmes), medicine	7
6	Bachelor degree / Engineering diploma / Urbanism diploma (Diploma de licenta / Diploma de inginer / Diploma de urbanist) and Diploma supplement (first cycle of higher education) Certificate of professional* competence (Certificat de atestare a competentelor profesionale) (postgraduate studies) Graduation certificate (Certificat de absolvire) (postgraduate studies)	6
5	Short cycle higher education certificate (Diploma de absolvire/calificare) and Certificate supplement (short cycle higher education) Post-secondary certificate (Certificat de calificare) and Descriptive supplement (post-secondary non-higher tertiary education)	5
4	Upper secondary school leaving certificate (Diploma de Bacalaureat) (general, technological or vocational education, four years of study) VET certificate level 4 (Certificat de calificare) and Descriptive supplement (technological / vocational high-school) VET certificate level 4 / Qualification/Graduation certificate (Certificat de calificare/absolvire) and Descriptive supplement (authorised training provider / training programme) VET certificate level 4 / Qualification certificate (Certificat de calificare) and Descriptive supplement (authorised training provider / apprenticeship programmes in the workplace)	4
3	VET certificate level 3 / Qualification certificate (Certificat de calificare) and Descriptive Supplement (authorised training provider / apprenticeship programmes in the workplace) VET certificate level 3 / Qualification certificate / Certificate of professional competence (Certificat de calificare / Certificat de competente profesionale) and Descriptive supplement (accredited training centre) VET certificate level 3 / Certificate of professional* competence (Certificat de competente profesionale) (authorised assessment centre) VET certificate level 3 / Qualification/Graduation certificate (Certificat de calificare/absolvire) and Descriptive supplement (authorised training provider / training programme) VET certificate level 3 / Qualification certificate (Certificat de calificare) and Descriptive supplement (education unit / technological/vocational high school) VET certificate level 3 / Qualification certificate (Certificat de calificare) and Descriptive supplement (education unit / vocational training programme organised in dual system) VET certificate level 3 / Qualification certificate (Certificat de calificare) and Descriptive supplement (education unit / professional* education lasting at least 3 years)	3
2	VET certificate level 2 / Qualification certificate (Certificat de calificare) and Descriptive supplement (authorised training provider / apprenticeship programmes in the workplace) VET certificate level 2 / Qualification certificate / Certificate of professional competence (Certificat de calificare / Certificat de competente profesionale) and Descriptive supplement (accredited training centre) VET certificate level 2 / Certificate of professional* competence (Certificat de competente profesionale) (authorised assessment centre) VET certificate level 2 / Qualification/Graduation certificate (Certificat de calificare/absolvire) and Descriptive supplement (authorised training provider / training programme)	2
1	Certificate of professional* competence (Certificat de competente profesionale) (authorised assessment centre) Graduation certificate (Certificat de absolvire) and Descriptive supplement (authorised training provider / training programme) Graduation Diploma (Diploma de absolvire) (basic education unit), 8 years	1

Source: [12], [51]

5.1.2.6 National Qualification framework in Slovakia

Slovak qualifications framework (SKKR) has been under work for some time, based on a 2009 government decision on EQF implementation. The 2009 Act on Lifelong Learning, amended in 2012 (Law 315/2012), stipulated the legal background for the development of a national qualification system and framework; the tasks related to these developments became part of the national reform programme. In 2013, strategies for revision of the initial NQF proposal, deemed to be too much shaped around formal education, were put forward, along with wider involvement of social partners.

The system consists of two pillars, the SKKR and the national qualifications register (NQR) [53]: their development was closely related. The description of qualifications in terms of qualification standards forms the content of the NQR; their levelling is the content of SKKR. The first phase of SKKR development was finalised in 2015, with the revision of the SKKR grid and approval of the methodology for linking qualifications to SKKR levels. The framework includes all qualifications: it consists of four sub-frameworks for general education, VET, higher education, and occupational qualifications (awarded outside the formal system, as a result of courses and work experience). It is an eight-level, learning-outcomes-based framework, with level descriptors defined in terms of knowledge (general and professional), skills (cognitive and practical) and competence (responsibility, autonomy and social competences) (Table 5.6.). The architecture of the SKKR consists of the framework grid and a catalogue of qualification cards describing full and partial qualifications. Qualifications were assigned to SKKR levels following analysis of the learning outcomes set in the qualification standards, and their comparison with the national descriptors. Implementation and further development of the framework are work in progress.

The overarching SKKR was referenced to the EQF in October 2017 and the referencing report was approved by the Slovak government in November 2017.

Table 5.6 Slovak national qualifications framework (SKKR)

SKKR levels	Qualification types	EQF levels
8	Diploma (*Vysokoškolský diplom*) + Certificate of State exam (*Vysvedčenie o štátnej skúške*) + Diploma supplement (*Dodatok k diplomu*)	8
7	Diploma (*Vysokoškolský diplom*) + Certificate of State exam (*Vysvedčenie o štátnej skúške*) + Diploma supplement (*Dodatok k diplomu*) Certificate of qualification (*Osvedčenie o kvalifikácii*)	7
6	Diploma (*Vysokoškolský diplom*) + Certificate of State exam (*Vysvedčenie o štátnej skúške*) + Diploma supplement (*Dodatok k diplomu*) Certificate of qualification (*Osvedčenie o kvalifikácii*)	6
5	*Maturita* certificate (*Vysvedčenie o maturitnej skúške*) + Certificate of apprenticeship (*Výučný list*) *Maturita* certificate (*Vysvedčenie o maturitnej skúške*) Certificate of final post-secondary exam (*Vysvečenie o absolventskej skúške*) + Absolutorium diploma (*Absolventský diplom*) Certificate of qualification (*Osvedčenie o kvalifikácii*)	5
4	*Maturita* certificate (*Vysvedčenie o maturitnej skúške*) + Certificate of apprenticeship (*Výučný list*) *Maturita* certificate (*Vysvedčenie o maturitnej skúške*) Certificate of qualification (*Osvedčenie o kvalifikácii*)	4
3	Certificate of final exam (*Vysvedčenie o záverečnej skúške*) + Certificate of apprenticeship (*Výučný list*) Certificate of qualification (*Osvedčenie o kvalifikácii*)	3

SKKR levels	Qualification types	EQF levels
2	Lower secondary education certificate with supplement (*Vysvedčenie s doložkou*) Certificate of final exam (*Vysvedčenie o záverečnej skúške*) + Certificate of apprenticeship (*Výučný list*) Certificate of qualification (*Osvedčenie o kvalifikácii*)	2
1	Primary education certificate with supplement (*Vysvedčenie s doložkou*)	1

Source: [12], [63] [64]

5.1.3 Skills Anticipation

Skills anticipation can be a powerful policy tool for decision-making. Individuals would benefit greatly from knowing what type of education and training to follow; enterprises would know the skills they need; and policy-makers could adapt education and training systems to new skill needs.

Understanding current and future labour market demand, and how it will shape both the need to reskill the current workforce and vocational training, helps to formulate skills development and active labour market policies. It also informs decisions on budgetary allocations to various vocational training programmes and contributes to the design of competency standards. Relevant labour market information on current and future skill needs also supports individual decisions and career counselling and vocational guidance services.

As outlined in the European Commission's *New skills agenda for Europe* and a global one in the 2017 update of UNESCO's Shanghai Consensus it is a European Union policy priority [13]. But collecting, analysing and using labour market and skills intelligence (LMSI) in policy-making must be based on processes, supported by government authorities, embraced and enriched by stakeholder input and commitment.

For CEDEFOP, skills anticipation and matching are the process of producing and building on available LMSI to achieve a better balance between skill supply and demand, to promote economic development through targeted skills investments by individuals, countries, regions, sectors or enterprises. Skills anticipation is not manpower planning and it does not try to predict how many workers with certain skills we will need in 2025 [15]. Skills anticipation examines how labour markets are developing and, consequently, how jobs, skills and learning needs are changing. It is not a crystal ball and makes no claim to being able to predict skills evolution with any certainty, but skills anticipation can signal current and possible future skill mismatches and inform decisions on how to address them [44].

CEDEFOP's overviews of skills anticipation highlight that all Member States (box) are establishing new and/or expanding existing skills anticipation activities and strengthening their use in policy-making.

Effective skills anticipation and matching, based on high quality LMSI, can link education, training and employment. It can encourage partnerships and cooperation to deliver VET skills and qualifications relevant to the workplace and respected by employers.

Consequently, Member States use skills anticipation at national and regional levels to support many employment and education- and training-related policies (Table 5.1). Some use skills anticipation to support other policy areas: economic policy in Latvia and the transition to a greener and digital economy in Ireland. Government agencies and public employment services are not the only users of skills anticipation. For example, in Germany, France and Austria, social partners use skills anticipation to inform decision making at sector or enterprise level.

Table 5.7 Examples of policy areas supported by skills anticipation, EU member states

Policy area	Member states examples
VET curricula and course design	Bulgaria, Denmark, Germany, Estonia, Greece, France, Italy, Cyprus, Austria, Poland, Slovakia, Finland
Funding and allocation of student places	Hungary, Portugal, Romania, Finland, Sweden
Labour market training policies	Belgium, Bulgaria, Germany, Ireland, Spain, Latvia
Career guidance	Germany, France, Croatia, Italy, Lithuania, Luxembourg, Netherlands, Austria, Finland, UK
Developing occupational profiles and standards	Belgium, Slovenia
Job-matching and services for job-seekers	Denmark

Source: [13]

CEDEFOP's overviews examine skills anticipation approaches in all 28 EU Member States. They show differences and similarities in skills anticipation methods and tools, governance structures, dissemination and its use in policy-making. The overviews explore current approaches to skills anticipation, giving insights and possible policy lessons on how to get the best out of a potentially powerful policy tool.

5.2 European Commission Regulation on Air Transport

In this section the report focuses on the regulation regarding aircraft maintenance, air traffic control and air crew regulations.

5.2.1 Aircraft Maintenance

In accordance with article 67 of the EU 2018/ 1139 (Basic Regulation) "Validity and recognition of certificates and declarations", certificates issued by the Agency or the national competent authorities shall be valid and recognised in all Member States, without further requirements or evaluation. Therefore, the Aircraft Maintenance License (Part 66) issued by Romanian Civil Aviation Authority (designated competent authority for civil aviation in Romania) should be recognised in all Member States, without further requirements or evaluation.

Annex III to EU 1321/2014 (Part 66) contains a detailed presentation regarding the conditions to be achieved in order to obtain Aircraft Maintenance License (AML) (Part 66 license). The AML (together with the certification authorisation issued by the maintenance organisation) allows the holder to certify maintenance work and to release the aircraft to service after maintenance checks.

Annex III (Part 66) to Regulation (UE) 1321/2014, describes the criteria, in terms of theoretical knowledge and practical experience. The certification of the qualified personnel is stated by an Aircraft Maintenance License (AML). AML includes the following categories:

- Category A (EQF Qualification Level 5)– Aircraft Line Maintenance Technician

- Category B1 (EQF Qualification Level 5) – Aircraft Line and Base Maintenance Technician/Engineer – Mechanic
- Category B2 (EQF Qualification Level 5) – Aircraft Line and Base Maintenance Technician/Engineer – Avionics
- Category B3 (EQF Qualification Level 5) - Aircraft Line and Base Maintenance Technician/Engineer Mechanic (applicable ONLY to piston-engine non-pressurised aeroplanes of 2000 kg MTOM and below)
- Category C (EQF Qualification Level 5)- Base Maintenance Certifying Engineer

Aircraft Maintenance Categories Privileges

- **Category A (Mechanics)**

Category A aircraft maintenance licence permits the holder to issue certificates of release to service following minor scheduled line maintenance and simple defect rectification within the limits of tasks specifically endorsed on the authorisation. The certification privileges shall be restricted to work that the licence holder has personally performed in the Part-145 organisation that issued the certification authorisation.

Category A has 4 subcategories:

- Category A1 – Aeroplanes Turbine
- Category A2 – Aeroplanes Piston
- Category A3 – Helicopters Turbine
- Category A4 – Helicopters Piston

Minimum requirements to obtain Part 66 Category A :

- Theoretical requirements: successfully passing the applicable modules in Annex I to Annex III (Part 66) to EU 1321/2014 and
- Practical experience: 1 to 3 years practical maintenance experience on operating aircraft, depending on the licence subcategory applied for.

- **Category B1 (Technician-Mechanic)**

A category B1 aircraft maintenance licence shall permit the holder to issue certificates of release to service following maintenance, including aircraft structure, powerplant and mechanical and electrical systems. Replacement of avionic line replaceable units, requiring simple tests to prove their serviceability, shall also be included in the privileges. Category B1 automatically includes the appropriate A subcategory.

Category B1 has 4 subcategories:

- Category B1.1 – Aeroplanes Turbine
- Category B1.2 – Aeroplanes Piston
- Category B1.3 – Helicopters Turbine
- Category B1.4 –Helicopters Piston

- **Category B2 (Technician-Avionics)**

A category B2 Aircraft Maintenance Licence shall permit the holder to issue certificates of release to service following maintenance on avionic and electrical systems.

- **Category B3 (Technician -Mechanics)**

A Category B3 aircraft maintenance licence shall permit the holder to issue certificates of release to service following maintenance on non-pressurised piston engine aeroplanes, sailplanes and motor-powered sailplanes with MTOM less than 2000 Kg, requiring simple tests to prove their serviceability.

Minimum requirements to obtain Part 66 Cat B: Theoretical requirements: Successfully passing the applicable modules in Annex I to Annex III (Part 66) to EU 1321/2014 and Practical experience: 2 to 5 years practical maintenance experience on operating aircraft, depending on the licence subcategory applied for.

- **CATEGORY C**

A category C aircraft maintenance licence shall permit the holder to issue certificates of release to service following base maintenance on aircraft. The privileges apply to the aircraft in its entirety in a Part-145 organisation.

Minimum requirements to obtain Part 66 Cat C : Theoretical requirements: successfully passing the applicable modules in Annex I to Annex III (Part 66) to EU 1321/2014 and Practical experience: 3 to 5 years of practical experience exercising B1 or B2 privileges OR through academic route (an applicant holding an academic degree in a technical discipline, from a university or other higher educational institution recognised by the competent authority, 3 years of experience working in a civil aircraft maintenance environment, including 6 months of observation of base maintenance tasks).

General Requirements for AML

The applicant must be at least 18 years old in order to be accepted in the theoretical examination process. In order to be certifying staff, a person must be at least 21 years old.

Theoretical and practical experience requirements to obtain AML: theoretical examinations *in accordance with EASA requirements, theoretical training is not mandatory before examinations.* EASA has defined modules and knowledge requirements for every category. According to Part 66, the basic subjects required in order to get the qualification are: M01 – Mathematics, M02 – Physics, M03 – Electrical fundamentals, M04 – Electronic fundamentals, M05 – Digital techniques, M06 – Materials and hardware, M07 – Maintenance practices, M08 – Basic aerodynamics, M09 – Human factors, M10 – Aviation legislation, M11 – Turbine aeroplane aerodynamics, structures and systems, M12 – Helicopter aerodynamics, structures and systems, M13 – Aircraft aerodynamics, structures and systems, M14 – Propulsion, M15 – Turbine engine, M16 – Piston engine, M17 – Propeller;

Moreover, depending on the category of Part 66 license applied for, the applicant has to prove practical experience between 1 and 5 years. The practical experience has to be achieved within an approved maintenance organisation (Part 145, FAA, etc.)

5.2.2 Air Traffic Control

Commission Regulation (EU) 2015/340 of 20 February 2015 is laying down technical requirements and administrative procedures relating to air traffic controllers' licenses and certificates pursuant to Regulation (EC) No

216/2008 of the European Parliament and of the Council, amending Commission Implementing Regulation (EU) No 923/2012 and repealing Commission Regulation (EU) No 805/2011

This Regulation lays down detailed rules for:

(a) the conditions for issuing, suspending and revoking air traffic controllers and student air traffic controllers' licences, associated ratings and endorsements, and the privileges and responsibilities of those holding them;

(b) the conditions for issuing, limiting, suspending and revoking air traffic controllers and student air traffic controllers' medical certificates, and the privileges and responsibilities of those holding them;

(c) the certification of aero-medical examiners and aero-medical centres for air traffic controllers and student air traffic controllers;

(d) the certification of air traffic controller training organisations; (e) the conditions for validating revalidating, renewing and using such licences, ratings, endorsements and certificates.

This Regulation shall apply to:

(a) student air traffic controllers and air traffic controllers exercising their functions within the scope of Regulation (EC) No 216/2008;

(b) persons and organisations involved in the licensing, training, testing, checking and medical examination and assessment of applicants in accordance with this Regulation.

Requirements

1. The student air traffic controllers, the air traffic controllers and the persons involved in the licensing, training, testing, checking and medical examination and assessment of applicants referred to in Article 1(2)(a) and (b) shall be qualified and licensed in accordance with the provisions of Annexes I, III and IV by the competent authority referred to in Article 6.

2. The organisations referred to in Article 1(2)(b) shall be qualified in accordance with the technical requirements and administrative procedures laid down in Annexes I, III and IV and shall be certified by the competent authority referred to in Article 6.

3. The medical certification of the persons referred to in Article 1(2)(a) and (b) shall be compliant with the technical requirements and administrative procedures laid down in Annexes III and IV.

4. Air traffic controllers employed by air navigation service providers providing air traffic services in the airspace of the territory to which the Treaty applies and having their principal place of operations and their registered office, if any, located outside the territory subject to the provisions of the Treaty, shall be deemed to have been licenced in accordance with paragraph 1, where they meet both of the following conditions:

a) they hold an air traffic controller licence issued by a third country in accordance with Annex 1 to the Chicago Convention;
b) they have demonstrated to the competent authority referred to in Article 6 that they have received training and successfully passed examinations and assessments equivalent to those required by

Part ATCO, Subpart D, Sections 1-4, set out in Annex I. The tasks and functions assigned to the air traffic controllers referred to in the first subparagraph shall not exceed the privileges of the licence issued by the third country.

5. Practical instructors and assessors employed by a training organisation located outside the territory of the Member States shall be deemed to have been qualified in accordance with paragraph 1, where they meet both of the following conditions:

a. they hold an air traffic controller licence issued by a third country in accordance with Annex I of the Chicago Convention with a rating and, if applicable, rating endorsement corresponding to the one for which they are authorised to instruct or assess;
b. they have demonstrated to the competent authority referred to in Article 6 that they have received training and successfully passed examinations and assessments equivalent to those required by Part ATCO, Subpart D, Section 5, set out in Annex I.

The privileges referred to in the first subparagraph shall be specified in a certificate issued by a third country and shall be limited to provide instruction and assessment for training organisations located outside the territory of the Member States.

There are two types of licences: student air traffic controller licence and air traffic controller licence

Requirements for student air traffic controller licence

a. Holders of a student air traffic controller licence shall be authorised to provide air traffic control services in accordance with the rating(s) and rating endorsement(s) contained in their licence under the supervision of an on the-job training instructor and to undertake training for rating endorsement(s).
b. Applicants for the issue of a student air traffic controller licence shall:
    1) be at least 18 years old;
    2) have successfully completed initial training at a training organisation satisfying the requirements laid down in Annex III (Part ATCO.OR) relevant to the rating, and if applicable, to the rating endorsement, as set out in Part ATCO, Subpart D, Section 2;
    3) hold a valid medical certificate;
    4) have demonstrated an adequate level of language proficiency in accordance with the requirements set out in ATCO.B.030.
c. The student air traffic controller licence shall contain the language endorsement(s) and at least one rating and, if applicable, one rating endorsement.
d. The holder of a student air traffic controller licence who has not started exercising the privileges of that licence within one year from the date of its issue or has interrupted exercising those privileges for a period of more than one year may only start or continue unit training in that rating

after an assessment of his/her previous competence, conducted by a training organisation satisfying the requirements laid down in Annex III (Part ATCO.OR) and certified to provide initial training relevant to the rating, as to whether he/she continues to satisfy the requirements relevant to that rating, and after satisfying any training requirements resulting from this assessment.

Air traffic controller licence

(a) Holders of an air traffic controller licence shall be authorised to provide air traffic control services in accordance with the ratings and rating endorsements of their licence, and to exercise the privileges of the endorsements contained therein.

(b) The privileges of an air traffic controller licence shall include the privileges of a student air traffic controller licence as set out in ATCO.B.001(a).

(c) Applicants for the first issue of an air traffic controller licence shall:

(1) hold a student air traffic controller licence;

(2) have completed a unit endorsement course and successfully passed the appropriate examinations and assessments in accordance with the requirements set out in Part ATCO, Subpart D, Section 3;

(3) hold a valid medical certificate;

(4) have demonstrated an adequate level of language proficiency in accordance with the requirements set out in ATCO.B.030.

(d) The air traffic controller licence shall be validated by the inclusion of one or more ratings and the relevant rating, unit and language proficiency endorsements for which the training was successful. (e) The holder of an air traffic controller licence who has not started exercising the privileges of any rating within one year from the date of its issue may only start unit training in that rating after an assessment of his/her previous competence, conducted by a training organisation satisfying the requirements laid down in Annex III (Part ATCO.OR) and certified to provide initial training relevant to the rating, as to whether he/she continues to satisfy the requirements relevant to that rating, and after satisfying any training requirements resulting from this assessment.

Air traffic controller ratings

(a) Licences shall contain one or more of the following ratings in order to indicate the type of service which the licence holder is authorised to provide:

(1) the Aerodrome Control Visual (ADV) rating, indicating that the licence holder is competent to provide an air traffic control service to aerodrome traffic at an aerodrome that has no published instrument approach or departure procedures;

(2) the Aerodrome Control Instrument (ADI) rating, indicating that the licence holder is competent to provide an air traffic control service to aerodrome traffic at an aerodrome that has published instrument approach or departure procedures and shall be accompanied by at least one of the rating endorsements described in ATCO.B.015(a);

(3) the Approach Control Procedural (APP) rating, indicating that the licence holder is competent to provide an air traffic control service to arriving, departing or transiting aircraft without the use of surveillance equipment;

(4) the Approach Control Surveillance (APS) rating, indicating that the licence holder is competent to provide an air traffic control service to arriving, departing or transiting aircraft with the use of surveillance equipment;

(5) the Area Control Procedural (ACP) rating, indicating that the licence holder is competent to provide an air traffic control service to aircraft without the use of surveillance equipment;

(6) the Area Control Surveillance (ACS) rating, indicating that the licence holder is competent to provide an air traffic control service to aircraft with the use of surveillance equipment.

(b) The holder of a rating who has interrupted exercising the privileges associated with that rating for a period of four or more immediately preceding consecutive years may only start unit training in that rating after assessment of previous competence, conducted by a training organisation satisfying the requirements laid down in Annex III (Part ATCO.OR) and certified to provide training relevant to the rating, as to whether the person concerned continues to satisfy the conditions of that rating, and after satisfying any training requirements resulting from this assessment.

5.2.3 Air Crew Regulations

Pilot licensing regulations are being standardised across all member states of the European Aviation Safety Agency (EASA). These licences are known as EASA licences or Part-FCL licences. The Commission Regulation (EU) No 1178/2011 [75] of 3 November 2011 lays down all rules for training and issue of the following licence: light aircraft pilot licence (LAPL), the private pilot licence (PPL), the sailplane pilot licence (SPL), balloon pilot licence (BPL) and the professional licences: the commercial pilot licence (CPL) and airline pilot licence (ATPL).

Commission Regulation (EU) No 1178/2011 of 3 November 2011[75] (EASA Air Crew) and its subsequent amendments lay down technical requirements and administrative procedures related to civil aviation aircrew.

This Regulation lays down detailed rules for:

1. different ratings for pilots' licences (ex: light aircraft pilot licence — LAPL, private pilot licence (PPL), sailplane pilot licence (SPL) and balloon pilot licence (BPL), commercial pilot licence — CPL, multi-crew pilot licence — MPL, airline transport pilot licence — ATPL, instrument rating — IR, class and type ratings, additional ratings, instructors, examiners), the conditions for issuing, maintaining, amending, limiting, suspending or revoking licences, the privileges and responsibilities of the holders of licences, the conditions for the conversion of existing national pilots' licences and of national flight engineers' licences into pilots' licences, as well as the conditions for the acceptance of licences from third countries;
2. the certification of persons responsible for providing flight training or flight simulation training and for assessing pilots' skills;
3. different medical certificates for pilots, the conditions for issuing, maintaining, amending, limiting, suspending or revoking medical certificates, the privileges and responsibilities of the holders of medical certificates as well as the conditions for the conversion of national medical certificates into commonly recognized medical certificates;

4. the certification of aero-medical examiners, as well as the conditions under which general medical practitioners may act as aero-medical examiners;
5. the periodical aero-medical assessment of cabin crew members, as well as the qualification of persons responsible for this assessment.

All applicants need to finish a course within an ATO (Approved Training Organization) at the very beginning of flying training a candidate need to make a choice about which training path to follow, integrated or modular. It is important to remember that both integrated and modular courses are 'approved', that the flight tests and ground exams are exactly the same in both cases and that the license an applicant get at the end is exactly the same. The differences are in: the time it takes, the flying hours an applicant end up with, the cost, the number of training providers. Integrated pilot training generally takes between 14 and 18 months depending on weather, student progress, and other external factors. An Integrated course - this is an intensive full-time course, which takes around 18 months to complete. The training providers take students from zero hours of flying up to the required amount for the ATPL, or can provide a Modular training - this is offered by the same training providers and covers the same topics and examinations as the integrated route but can be carried out in chunks, allowing to complete sections as the applicant can afford them and work in between if needed. The theory side of the course can be completed as either a full-time classroom course or as a distance-learning course so the applicant can work at the same time, the amount of time spent in actual classroom instruction shall not be less than 10 % of the total duration of the course. Thereby modular course provide training in steps, first step in obtaining an ATPL licence is a PPL licence after this an applicant need to obtain associated ratings Single Engine(A), Multi Engine (A), Instrumental Rating(A) and gaining the number of hours and experience will be able to get Commercial Pilot Licence. An applicant for a PPL shall be at least 17 years of age, for a CPL shall be at least 18 years of age and for an ATPL shall be at least 21 years of age. To become a pilot, the requires a pilot to obtain an aviation medical certificate. Pilot medical requirements vary depending on age and what type of pilot certificate. Applicants for, and holders of a PPL(A), shall hold at least a Class 2 medical certificate, and holders of a CPL(A) / ATPL (A), shall hold a Class 1 medical certificate.

Advantages: Integrated training can be completed in a shorter time, i.e. less flexibility; On the other hand, t*he disadvantages are t*he comparatively high cost of the course and secondly, one must complete all training and pass all the exams to be eligible for CPL/IR license.

Modular training allows you to complete sections or modules of training according to your time plan and availability. In a structured modular course, you deal with one school that would be able to provide all the training. Structured modular courses can be completed in about 18 months or slightly longer, but at the cost of a well-organized modular course. Modular pilot training takes no less than 18 months, depending on student progress, weather, and other factors.

*The advantages are three folded: first, t*he cost is much less than an integrated course; second one can choose the best training provider for each module and third one ca stop the training and continue at a later date; However the disadvantage *is that t*he completion time is longer.

Aeroplane, helicopter, powered-lift and airship pilots required to use the radio telephone shall not exercise the privileges of their licences and ratings unless they have a language proficiency endorsement on their licence in either

English or the language used for radio communications involved in the flight. The endorsement shall indicate the language, the proficiency level and the validity date. The demonstration of language proficiency and of the use of English shall be done through a method of assessment established by the competent authority. Entrance requirements in an ATO should ensure that the students have enough knowledge, particularly of physics and mathematics, to be able to follow the courses. Obtaining any licence / rating consists of two stages:

Theoretical knowledge examinations for the issue of licences, Applicants shall demonstrate a level of theoretical knowledge (within ATO, after ATO recommendation at CAA) appropriate to the privileges granted through examinations in the following subjects:

a) common subjects: Air law, Human performance, Meteorology, and Communications;
b) specific subjects concerning the different aircraft categories: Principles of flight, Operational procedures, Flight performance and planning, Aircraft general knowledge, and Navigation. For obtaining the ATPL licence, the subjects do not change, changing only the degree of difficulty of the subjects.

A pass in an examination paper will be awarded to an applicant achieving at least 75 % of the marks allocated to that paper; and

Skill test. Except for the issue of an airline transport pilot licence, the applicant for a skill test shall be recommended to CAA [70] for the test by the organization/person responsible for the training, once the training is completed. Checks should be completed in accordance with the authorized checklist for the aeroplane on which the test is being taken.

The way for obtaining an ATPL(A) licence is presented in Fig. 5.1. the entry level licence is called a Private Pilot Licence (PPL). This licence entitles the holder to exercise privileges as pilot in command of a light single piston aircraft (this basically means that applicant can fly a small aircraft). The minimum age to hold a PPL is 17 years old. To obtain this, the applicant needs to complete a minimum of 45 flying hours. Although 45 hours is the minimum requirement, most people will generally need about 60-70 hours to reach the sufficient standard, some people needing more and some less. Again, depending on the person, the aim is to fly first solo flight after just 15 hours of tuition.

As presented in Fig. 5.1. an applicant has 3 Options to obtain the CPL licence. The CPL is basically a more advanced PPL, requiring greater accuracy in flying and a higher standard of airmanship. The holder of a CPL is able to act as pilot in command of a small piston engine aircraft that holds less than 9 passengers for commercial purposes such as revenue flights in visual conditions (VMC). The minimum age to hold a CPL is 18 years old. The CPL is valid for multi engine aircraft only if the CPL skills test is passed in a multi engine aircraft, otherwise privileges are restricted to single engine aircraft. A CPL holder may only operate the aircraft in what are referred to as visual meteorological conditions (VMC – this basically means clear of cloud with the ground always in sight in good visibility). In order to operate in cloud or instrument meteorological conditions (IMC), this means flying the aircraft using only it's instruments without reference to the ground or horizon, the pilot must hold an instrument rating, again specific to a single or multi engine aircraft. When training for the instrument rating, the instructor will place special screens up in the windshield of the aircraft, or the student will wear special goggles to ensure the student can't see outside. The screens go up at about 400 feet above ground level and are removed when coming into land at about the same height. After take-off, the student must navigate only using the aircraft instruments and radio beacons on a predetermined routing. A typical route involves navigating to another airfield, making an instrument approach followed by carrying out a missed approach before navigating back to the departure aerodrome to land.

In order to operate on commercial airliner, the minimum qualification (licence) candidate must hold is a frozen Air Transport Pilots Licence (ATPL) with a Type Rating specific to the aircraft candidate is employed to operate and a class one medical. The Frozen ATPL consists of several individual licences and endorsements, all of which must be obtained in order to apply for a commercial flying job. This consists of 14 ground school examinations, a Multi Engine (ME) Commercial Pilots Licence (CPL), Multi Engine Instrument Rating (IR) and a Multi Crew Co-operation Course (MCC). These individual licences are explained in greater detail above.

The frozen ATPL becomes “unfrozen” i.e. a full ATPL, when candidate have completed a total of 1500 hours total flying time, of which 500 hours must be multi crew environment i.e. flown in an aircraft which requires both a captain and first officer. Candidate must be aged 21 or over for the licence to be unfrozen.

For licence issue an applicant for pilot/air traffic controller/maintenance personal need to comply with prerequisites listed in tables below. Therewith the differences between EASA and ICAO requirements are specified. Table 5.8

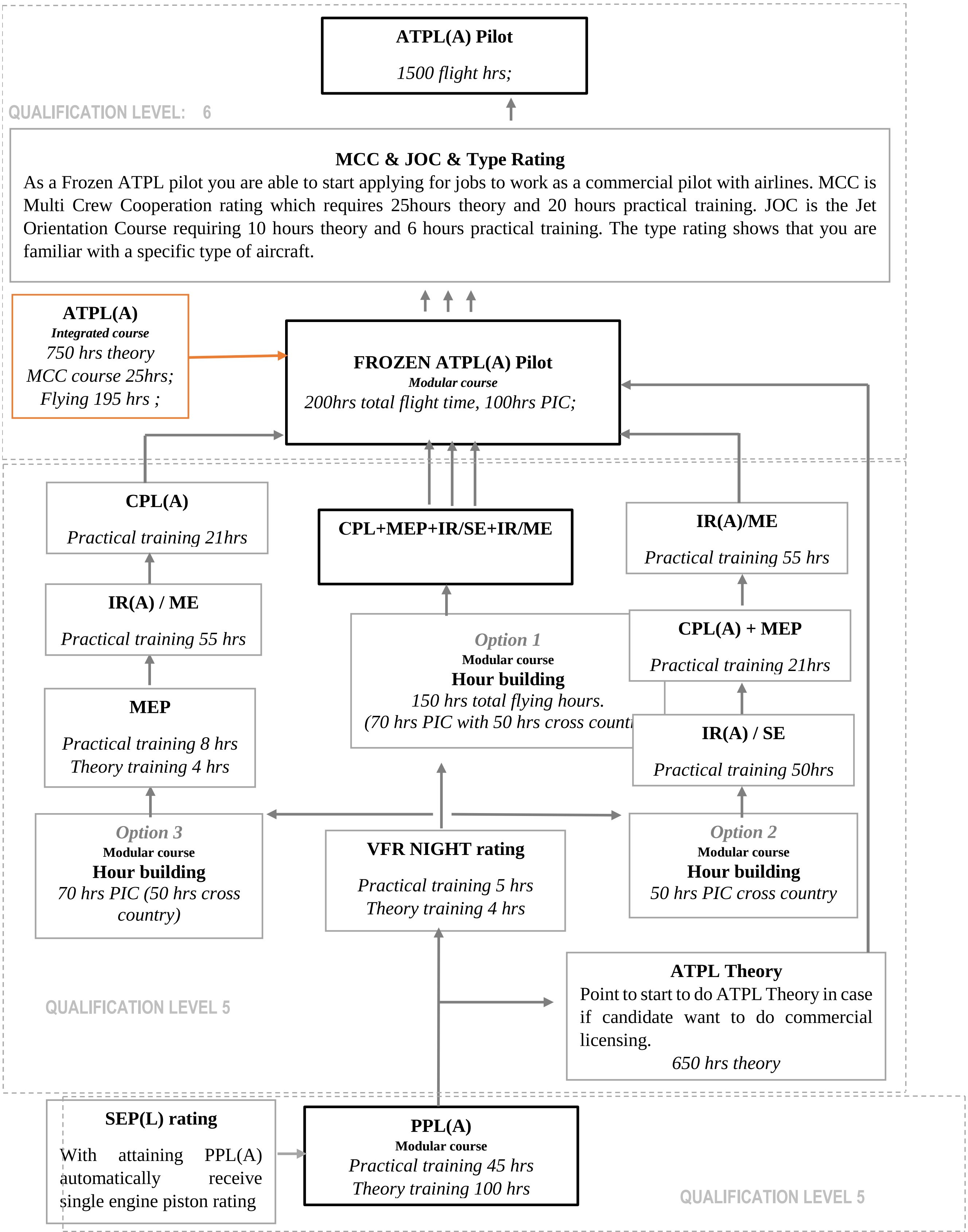

Figure 5.1 Integrated and Modular ATPL(A) programme pathway

Table 5.8 General prerequisites for PPL/CPL/ATPL licence issue in accordance with EASA and ICAO Regulations

Minimum requirements \ License		Private Pilot License	Commercial Pilot License	Airline Transport Pilot License
International Regulation	EASA R.1178/2011	1. An applicant for a PPL shall be at least 17 years of age; 2. Shall hold at least a Class 2 medical certificate;	1. An applicant for a CPL shall be at least 18 years of age; 2. Have enough knowledge of mathematics, physics and English; 3. Shall hold a Class 1 medical certificate;	1. Applicants for an ATPL shall be at least 21 years of age; 2. Shall hold an MPL or a CPL(A) and a multi-engine IR for airplanes in this case, the applicant shall also have received instruction in MCC; 3. Have enough knowledge of mathematics, physics and English (have at least valid ICAO level 4 knowledge of English language); 4. Shall hold a Class 1 medical certificate;
	ICAO Annex 1	1. The applicant shall be not less than 17 years of age; 2. The applicant shall hold a current Class 2 Medical Assessment; 3. Demonstrate the ability to speak and understand the language used for radiotelephony communications.	1. The applicant shall be not less than 18 years of age; 2. The applicant shall hold a current Class 1 Medical Assessment; 3. Demonstrate the ability to speak and understand the language used for radiotelephony communications.	1. The applicant shall be not less than 21 years of age; 2. The applicant shall hold a current Class 1 Medical Assessment; 3. Demonstrate the ability to speak and understand the language used for radiotelephony communications.

Table 5.9 Minimum prerequisites for Air Traffic Controllers licence issue in accordance with EASA and ICAO Regulations

Minimum Prerequisites \ License		Air Traffic Controllers
International Regulation	EASA Commission Regulation (EU) 2015/340 of 20 February 2015 laying down technical requirements and administrative procedures relating to air traffic controllers' licences and certificates pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council, amending Commission Implementing Regulation (EU) No 923/2012 and repealing Commission Regulation (EU) No 805/2011 This Regulation is mandatory for EU members.	Applicants for the issue of a student air traffic controller licence shall: (1) be at least 18 years old; (2) have successfully completed initial training at a training organisation; (3) hold a valid medical certificate; (4) have demonstrated an adequate level of language proficiency. Air traffic controller licence (a) Holders of an air traffic controller licence shall be authorised to provide air traffic control services in accordance with the ratings and rating endorsements of their licence, and to exercise the privileges of the endorsements contained therein. (b) The privileges of an air traffic controller licence shall include the privileges of a student air traffic controller licence. (c) Applicants for the first issue of an air traffic controller licence shall: (1) hold a student air traffic controller licence; (2) have completed a unit endorsement course and successfully passed the appropriate examinations and; (3) hold a valid medical certificate; (4) have demonstrated an adequate level of language proficiency.
	ICAO Annex 1	**Age:** The applicant shall be not less than 21 years of age. **Knowledge:** The applicant shall have demonstrated a level of knowledge appropriate to the holder of an air traffic controller **Experience:** The applicant shall have completed an approved training course and not less than three months of satisfactory service engaged in the actual control of air traffic under the supervision of an appropriately rated air traffic controller. The experience requirements specified for air traffic controller ratings in 4.4 may be credited as part of the experience specified in this paragraph. **Medical fitness:** The applicant shall hold a current Class 3 Medical Assessment.

Table 5.10 Minimum prerequisites for Maintenance personnel licence issue in accordance with EASA and ICAO Regulations

License / Minimum Prerequisites		Air Traffic Controllers
International Regulation	EASA Commission Regulation (EU) 2015/340 of 20 February 2015 laying down technical requirements and administrative procedures relating to air traffic controllers' licences and certificates pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council, amending Commission Implementing Regulation (EU) No 923/2012 and repealing Commission Regulation (EU) No 805/2011 This Regulation is mandatory for EU members.	Applicants for the issue of a student air traffic controller licence shall: (1) be at least 18 years old; (2) have successfully completed initial training at a training organisation; (3) hold a valid medical certificate; (4) have demonstrated an adequate level of language proficiency. Air traffic controller licence (a) Holders of an air traffic controller licence shall be authorised to provide air traffic control services in accordance with the ratings and rating endorsements of their licence, and to exercise the privileges of the endorsements contained therein. (b) The privileges of an air traffic controller licence shall include the privileges of a student air traffic controller licence. (c) Applicants for the first issue of an air traffic controller licence shall: (1) hold a student air traffic controller licence; (2) have completed a unit endorsement course and successfully passed the appropriate examinations and; (3) hold a valid medical certificate; (4) have demonstrated an adequate level of language proficiency.
	ICAO Annex 1	**Age:** The applicant shall be not less than 21 years of age. **Knowledge:** The applicant shall have demonstrated a level of knowledge appropriate to the holder of an air traffic controller **Experience:** The applicant shall have completed an approved training course and not less than three months of satisfactory service engaged in the actual control of air traffic under the supervision of an appropriately rated air traffic controller. The experience requirements specified for air traffic controller ratings in 4.4 may be credited as part of the experience specified in this paragraph. **Medical fitness:** The applicant shall hold a current Class 3 Medical Assessment.

Table 5.11 Minimum prerequisites for Maintenance personnel licence issue in accordance with EASA and ICAO Regulations

<table>
<tr><td colspan="2">License
Minimum Prerequisites</td><td>Maintenance personnel</td></tr>
<tr><td rowspan="2">INTERNATIONAL REGULATION</td><td>EASA
Annex III to EU 1321/2014
Certifying staff</td><td>GENERAL REQUIREMENTS TO OBTAIN AML
The applicant must be at least 18 years old in order to be accepted in the theoretical examination process.
In order to be certifying staff, a person must be at least 21 years old.
Theoretical Requirements
NOTE: in accordance with EASA requirements, theoretical training is not mandatory before examinations.
EASA has defined modules and knowledge requirements for every category. According to Part 66, the basic subjects required in order to get the qualification are: M01 – Mathematics; M02 – Physics; M03 – Electrical fundamentals; M04 – Electronic fundamentals; M05 – Digital techniques; M06 – Materials and hardware; M07 – Maintenance practices; M08 – Basic aerodynamics; M09 – Human factors; M10 – Aviation legislation; M11 – Turbine aeroplane aerodynamics, structures and systems; M12 – Helicopter aerodynamics, structures and systems; M13 – Aircraft aerodynamics, structures and systems; M14 – Propulsion; M15 – Turbine engine; M16 – Piston engine; M17 – Propeller;
Practical Experience
Depending on the category of Part 66 license applied for, the applicant must prove practical experience between 1 and 5 years. The practical experience must be achieved within an approved maintenance organisation (Part 145, FAA, etc.)</td></tr>
<tr><td>ICAO
Annex I Personnel Licensing</td><td>Age: The applicant shall be not less than 18 years of age.
Knowledge: The applicant shall have demonstrated a level of knowledge relevant to the privileges to be granted and appropriate to the responsibilities of an aircraft maintenance licence holder, in at least the following subjects: Air law and airworthiness requirements; Natural science and aircraft general knowledge; Aircraft engineering; Aircraft maintenance; Human performance
Experience: The applicant shall have had the following experience in the inspection, servicing and maintenance of aircraft or its components:
a) for the issue of a licence with privileges for the aircraft in its entirety, at least:
1) four years; or
2) two years if the applicant has satisfactorily completed an approved training course; and
Training. Recommendation. The applicant should have completed a course of training appropriate to the privileges to be granted.
Skill. The applicant shall have demonstrated the ability to perform those functions applicable to the privileges to be granted.</td></tr>
</table>

5.3 International Civil Aviation Organization Regulations

Annex I to the Chicago Convention on International Civil Aviation – Personnel Licensing contains Standards and - Recommended Practices adopted by the International Civil Aviation Organization as the minimum standards for personnel licensing as follows:

Thus, ICAO Annex I provide SARPs on following subjects:

- **Licences and Ratings for pilots**: general rules concerning pilot licences, student pilot, private pilot licence, multi-crew pilot licence, airline transport pilot licence, instrument rating, flight instructor rating, glider pilot licence, free balloon pilot licence
- **Licences for flight crew other than licences for pilots**: general rules concerning flight navigator and flight engineer licence, flight navigator licence, flight engineer licence, flight radiotelephone operator
- **Licences and ratings for personnel other than flight crew members**: general rules, aircraft maintenance (technician/engineer/mechanic), student air traffic controller, air traffic controller licence, air traffic controller ratings, flight operations officer / flight dispatcher licence, aeronautical station operator licence, aeronautical meteorological personnel.
- **Specifications on personnel licences**
- **Medical provisions for licensing:** medical assessments, requirements for medical assessments, Class 1/2/3 medical assessment.

Also, ICAO Annex I provide information on the proficiency in languages used for radiotelephony Communications and Approved Training Organization

6 Competences and Qualifications Mismatch Impact on Accidents and Incidents in Air Transport

Currently, the air transport system is the safest transportation mode in the world, both by yearly number of casualties (total 120 for commercial passenger activity in 2017) and by yearly number of RPK flown before the occurrence of one fatality (420 trillion). The accident rate is the lowest it has ever been. This impressive record is due to many factors, including improvements in aircraft systems, reliability, continuous airworthiness requirements (mainly maintenance systems), pilot training, professional pilot skills, flight crew and air traffic procedures, improved safety data collection and analysis, and other efforts by industry and governments. However, incident and accident reports suggest that human errors by maintenance technicians or by flight crews still produce serious safety risks.

In the early days of flight, approximately 80% of accidents were caused by the machine and 20% were caused by human **error**. Today that **statistic** has reversed. An inventory of root or contributory causes shows that over 80% of air accidents and serious incidents (as important for safety analysis as the accidents) are the consequence of the inappropriate action or inaction of the human factor. And the main source of the errors of the operators (both in maintenance and in-flight operation) is a certain mismatch of their competences with the requirements of the tasks performed.

Several factors are projected to impact future operations

- Growth in the number of aircraft operations,
- Continuing changes in the demographics of the aviation workforce,
- Evolution in the knowledge and skills needed by pilot and maintenance technician.
- Historically low commercial aviation accident rates that make the cost/benefit case very challenging for additional safety and regulatory changes,
- Future airspace operations that exploit new technology and operational concepts for navigation, communication, surveillance, and air traffic management.

6.1 Safety Issues in Aircraft Maintenance Human Factor

According to *Aviation Safety Network* census, in the last 30 years about 12% of the world air transport accidents are due to faulty maintenance. Same source shows that the trend of the figure is in continuous decline, a probable consequence of the continuous improvement of the human factor competences. A taxonomy of the maintenance errors leading to accidents or serious incidents shows that nearly three of each four are installation related and could have been avoided by a better approach in precision and discipline training of the personnel. No current technical education is emphasizing such “soft” skills.

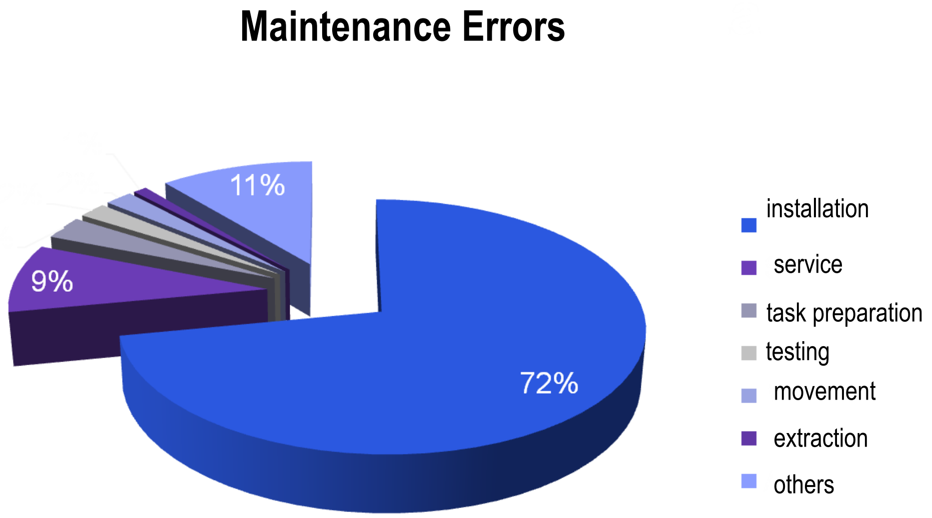

Figure 6.1 Maintenance errors

UK's Civil Aviation Authority CAP 1367 document issued in 2016 states that maintenance error continues to be one of the most obvious safety threats from an engineering or airworthiness perspective. Over the years, the evolution of aircraft design techniques, the use of new materials and using the learning from incidents and accidents has seen improvements in aircraft system design and component reliability. While accidents due to continuous airworthiness issues are relatively rare, they still do happen. This is because, despite improvements, the system of performing maintenance remains vulnerable to the issues surrounding human factors.

Humans are fallible and therefore errors and mistakes are still going to happen. It is through good training and competence assessment regimes that the likelihood of errors will be reduced.

Frequently, tight schedules are putting pressure on individuals to cut corners. If these violations from process and procedures where tolerated, both the individual and the organisation become exposed to accidents and incidents.

Training is essential, as engineering skills and good practice does not materialise out of thin air. Everyone involved in aircraft maintenance should possess the necessary competence, including the required behaviours and attitudes to do the job.

In an FAA manual, "*The Operator's Manual for Human Factors in Maintenance and Ground Operations*" [78] in Chapter 3 covering the topic, human factors training remains as a critical part of a safe and efficient maintenance organisation. When conducted properly, HF training provides a time to review the fundamentals, communication, to learn about emerging practices, policies, and challenges, and to renew each participant's commitment to the corporate safety goals. Ultimately, HF training teaches the technician to remain vigilant regarding their individual actions and how their actions influence safety.

6.2 Safety Issues in Flight Crew Training

While the maintenance error frequency (not increasing) seems to be kept under a relative control, during the last decades a new hazard was identified as the cause of more and more occurrences (accidents and incidents). The continuous rise in the use of automation aboard the aircraft as aid to pilot in his tasks reached a dangerous point in which the human could not keep abreast the automation and could not save a situation in which the computer failed to act properly.

Because the training of crew (both the initial one and the recurring episodes) concentrate mainly on the conformal use of the automation, consequently the manual flight skills were gradually ignored , with catastrophic effect in some cases. Two major accidents, Air France Flight 447 and Asiana Flight 214, with a total of nearly 600 victims, signalled dramatically the issue.

After this second event, FAA tasked a Working Group with participants from industry and other organizations to measure, analyse and propose solutions to the problem. WG issued a document, *Report of the PARC/CAST Flight Deck Automation WG [79]* (PARC is The Performance-Based Aviation Rulemaking Committee and CAST is the Commercial Aviation Safety Team). WG had extracted a large volume of data from conclusions of worldwide 26 accidents reviewed plus 20 major incidents, 734 reports on incident from ASRS (Aviation Safety Reporting System), accident reports, major incident reports, reports developed by an investigating board for events that do not meet the definition of an accident), 9155 aggregated reports from Line Operations Safety Audit (LOSA - a process by which trained observers audit a sampling of normal line operations for an operator during a specified period of time.) and research literature.

Based on its analyses, the WG determined 28 findings. Of these, a major interest for our study are Findings 11 and 12. Finding 11 shows that over 40% of the accidents may be traced to insufficient pilot knowledge (fig. 6.2). It is not a frequent phenomenon (just a few ASRS events) but when it happens the consequences are important (over 40% of the accidents).

Finding 12 is even more relevant for our subject: current training methods, training devices, the time allotted for training, and content may not provide the flight crews with the knowledge, skills and judgment to successfully manage flight path management systems (fig. 6.3). However, when reviewing the safety event reports, the WG identified all reports that noted training issues for flight path management and then separated them into deficiencies with training related to the use of automated systems (e.g., training for mode awareness) and other training deficiencies (e.g., manual handling). Results for both categories are presented in the figure bellow, a part of the Report.

The number of occurrences in which training deficiencies were identified is alarming, so necessary improvements should be made in flight crew training and qualification. Training was a factor in over 30% of the accidents. The following sections of Finding 12 in the Report organise the results into three categories: design of training and qualification programs; content of programs; and training for manual and automated flight operations.

For the moment, human action in the cockpit is still irreplaceable by the computer, so the human should be trained comprehensibly for this role.

Conclusions on the Impact of Qualifications on Safety

In both fields discussed above, a clear identification of the necessary qualifications of the personnel, followed by an effective adapting of the education to those needs is a condition to the most important aspect of the aviation, SAFETY.

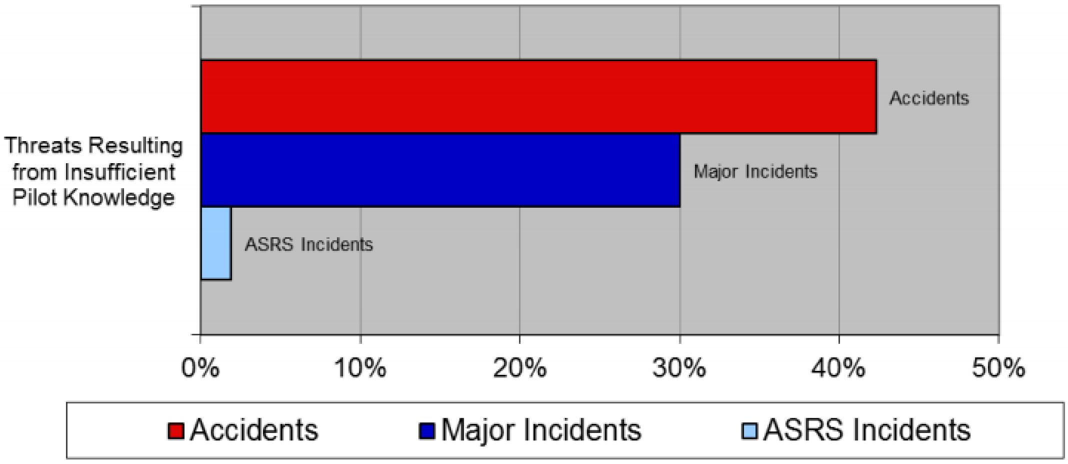

Figure 6.2 Threats Related to Insufficient Pilot Knowledge
Source: [79] pg. 64

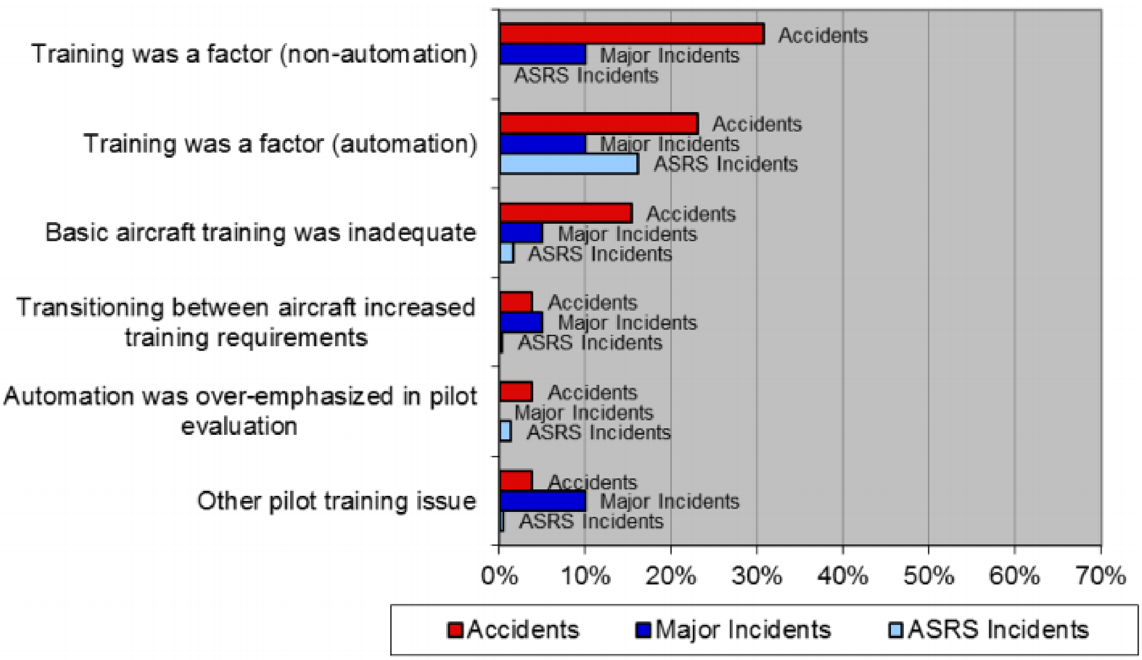

Figure 6.3 12 - Current Training Time, Methods, and Content.
Source:[79] pg.69

7 Politics in Air Transport Qualification

The European Aviation Vision 2050 objectives from Flightpath 2050:

Goal 1: “An air traffic management system in place that provides a range of services to handle at least 25 million flights a year of all types of air vehicles, including unmanned and autonomous systems integrated into and interoperable with the overall air transport system with 24-hour operation of airports. European airspace is used flexibly to facilitate reduced environmental impact from aircraft operation”

Goal 2 “A coherent ground infrastructure is developed including: airports, vertiports, heliports with the relevant servicing and connecting facilities, also to other modes”.

Goal 3 “European citizens are able to make informed mobility choices and have affordable access to one another, taking into account: economy, speed and level of service (that can be tailored to the individual customer). Continuous, secure and high-bandwidth communications are provided for added value applications”.

Goal 4: 90% of passengers within Europe are able to complete their journey, door to door within 4 hours. Passenger and freight are able to transfer seamlessly between transport modes to reach the final destination smoothly, predictably and on time”.

Goal 5: “Flights arrive within 1 minute of the planned arrival time regardless of weather conditions. The transport system is resilient against disruptive events and is capable of automatically and dynamically re-configuring the journey within the network to meet the needs of the traveller if disruption occurs. Special mission flights can be completed in the majority of weather, atmospheric conditions and operational environments”.

Goal 6: “The whole European aviation industry is strongly competitive, delivers the best products and services worldwide and has a share of more than 40% of the world market”.

Goal 7: “Europe will retain leading edge design, manufacturing and system integration capabilities and jobs supported by high profile, strategic, flagship projects and programmes which cover the whole innovation process from basic research to flight demonstrations”.

Goal 8 “Streamlined systems engineering, design, manufacturing, certification and upgrade processes have addressed complexity and significantly decreased development costs (including a 50% reduction in the cost of certification). A leading new generation of standards is created”.

Goal 9: “In 2050 technologies and procedures available allow a 75% reduction in CO_2 emissions per passenger km and a 90% reduction in NO_x emissions. The perceived noise of flying aircraft is reduced by 65%. These are relative to the capabilities of typical new aircraft in 2000”.

Goal 10: “Aircraft movements are emissions free when taxing”.

Goal 11: “Air vehicles are designed and manufactured to be recyclable

Goal 12: “Europe is established as a centre of excellence for sustainable alternative fuels, including those for aviation, based on a strong European energy policy.

Goal 13: "Europe is at the forefront of atmospheric research and takes the lead in the formulation of a prioritized environmental protection plan and the establishment of global environmental standards"

Goal 14: "European air transport system has less than one accident per million commercial aircraft flights"

Goal 15: "Weather and other hazards from environment are precisely evaluated and risks properly mitigated"

Goal 16: "The European air transport system operates seamlessly through interoperable and networked systems allowing manned and unmanned air vehicles to safely operate in the same airspace"

Goal 17: "Efficient boarding and safety measures allow seamless security for global travel with minimum passenger and cargo impact. Passengers and cargo pass through security controls without introduction"

Goal 18: "Air vehicles are resilient by design to current onboard and on the ground security threat evolution, internally and externally to the aircraft"

Goal 19: "The air transport system has fully secured global high bandwidth data network, hardened and resilient by design to cyber-attacks"

Goal 20: "European research and innovation strategies are jointly defined by all stakeholders, public and private, and implemented in a coordinated way with individual responsibly".

Goal 21: "Creation of a network of multidisciplinary technology clusters based on collaboration between industry, universities and research institutes"

Goal 22:" Identification, maintenance and ongoing development of strategic European aerospace test, simulation and development facilities. The ground and airborne validation and certification processes are integrated where appropriate"

Goal 23: Students are attracted to careers in aviation. Courses offered by European universities closely match the needs of the aviation industry, its research establishments and administration and evolve continuously as those needs develop.

The global unemployment rate stood at 5.7% in 2016, with women more likely to be unemployed than men across all age groups. Youth are almost three times as much as adults to be unemployed, making them the most vulnerable group when it comes to human resources. 76% of countries with data or more show that more than 1 in 10 youth are neither in the educational system nor working, with young women representing the exposed majority (Diversity And Inclusivity Are Key To Aviation's Sustainability: This Initiative Is Setting A Global Example By Uniting Aviation On Aug 16, 2018[3]).

Against this backdrop, ICAO is forecasting that air traffic volumes will double within fifteen years, meaning that it is crucial to ensure the international civil aviation network has access to sufficiently qualified and competent young

[3] https://www.unitingaviation.com/author/allisun/

professionals. Eliminating barriers related to gender, ethnicity, and poverty – to name a few – is therefore not only a moral imperative, but an operational one too.

The opportunities here are major, for both the personal development of these young people and for sustainable development of the societies they live in. Already, the aviation sector supports 63.5 million jobs globally, fully one third of world trade by value, and contributes more than 2.7 trillion dollars annually to global GDP. It also carries over half of the 1.4 billion tourists who travel across international borders each year, a contribution which establishes air transport as a significant economic lifeline for many cities, states and regions.

Figure 7.1 Airplane in airport at sunset. One worker leaving the airplane on empty cargo vehicle.

The impact of the industry's growth on States' socio-economic development and the attainment of the UN Agenda 2030 Sustainable Development Goals (SDGs) will be impossible to dismiss, making it an indisputable opportunity for States to invest in well-planned capacity building initiatives targeting youth, community outreach and gender-free opportunities.

7.1 European Skills, Competences, Qualifications and Occupations (ESCO)

ESCO is a multilingual classification system covering skills, competences, qualifications and occupations. Its common reference terminology can help make the European labour market more effective and integrated, and enable the worlds of work and education/training to communicate more effectively with each other.

ESCO is available in 27 languages, available free to all stakeholders and linked to relevant international classifications and frameworks, e.g.: International Standard Classification of Occupations, European Qualifications Framework.

ESCO is composed of 3 pillars:

- occupations
- skills/ competences
- qualifications

ESCO has established a common language to help bridge the communication gaps between different countries and between the domains of employment, education and training. It increases the transparency of occupations, qualifications, skills, competences and learning outcomes. This transparency and common reference points will help people to exchange information with unambiguous and shared meaning, independent of the language or electronic systems used. This is often referred to as semantic interoperability.

The publication of ESCO in July 2017 established a multilingual reference terminology that reflects realities in both the labour market and the education and training sector. ESCO aims to make the following factors clear:

- what knowledge, skills and competences are usually required when working in a specific occupation;
- what knowledge, skills and competence people gain as a result of a specific qualification;
- what qualifications are required or often requested when seeking work in a specific occupation.

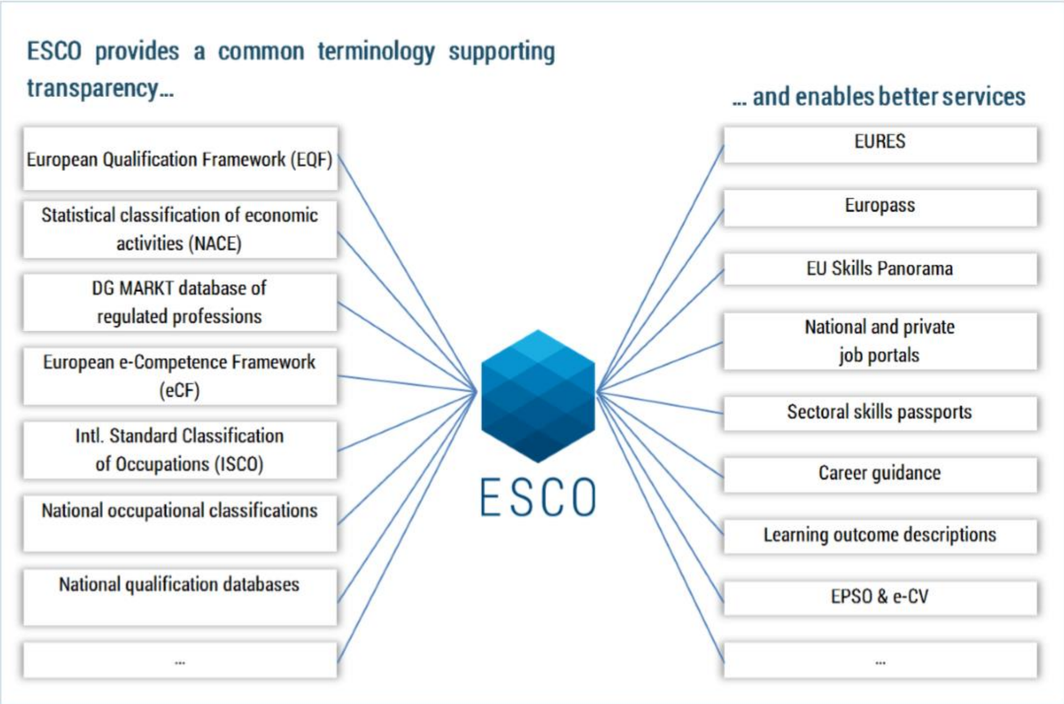

Figure 7.2 ESCO's terminology supporting transparency and enabling better services
Source: [29] pg. 9

7.2 ICT Practices for Guidance and Career Development in Air Transport

The primary objective of this chapter is to provide structured knowledge on activities, methods and tools supporting the successful integration of information and communication technologies (ICT) and labour market information (LMI) in career guidance services and presenting potential for transferability in air transport. The chapter aims to support air transport managers in identifying successful ICT and LMI initiatives to transfer to their context and providing guidelines on how to integrate them into their national context by identifying and analysing their essential components.

The chapter could serve as a starting point, as more elaborated information is available on the site addresses for ICT and LMI mentioned inside. The ICT and LMI practices presented have been selected using a multidimensional decision framework, with a view to meeting the following quality conditions: (a) compatibility with air transport priorities for career guidance; (b) innovativeness, exhibiting sufficient and reliable evidence for positive impact and successful implementation in the framework of career guidance centres at national and/or regional level; (c) relevance for air transport qualifications and labour market; (d) transferability and adaptability to other contexts; (e) size of training networks.

7.2.1 Civil Aviation Training Solutions

Civil Aviation Training Solutions (CAE) is the training partner of choice of aviation professionals, airlines, large fleet operators, and aircraft manufacturers the world over. With 50+ training locations across the globe, CAE has the largest civil aviation network in the world.

Training Locations. CAE has the world's largest civil aviation training network, with 250+ full-flight simulators in 50+ training locations in some of the world's most desirable destinations. Every year, CAE trains more than 120,000 pilots and graduates 1,000+ new pilots across its global network, from its wholly-owned, partially owned, joint ventures and authorized training centres. More than 2,000 highly-skilled instructors deliver world-class instruction and a dedicated customer service team ensure all your specific needs are met.

From cadet to captain, to cabin crew and maintenance training – to aviation recruitment and technical services - nobody meets your training needs more completely, or so globally.

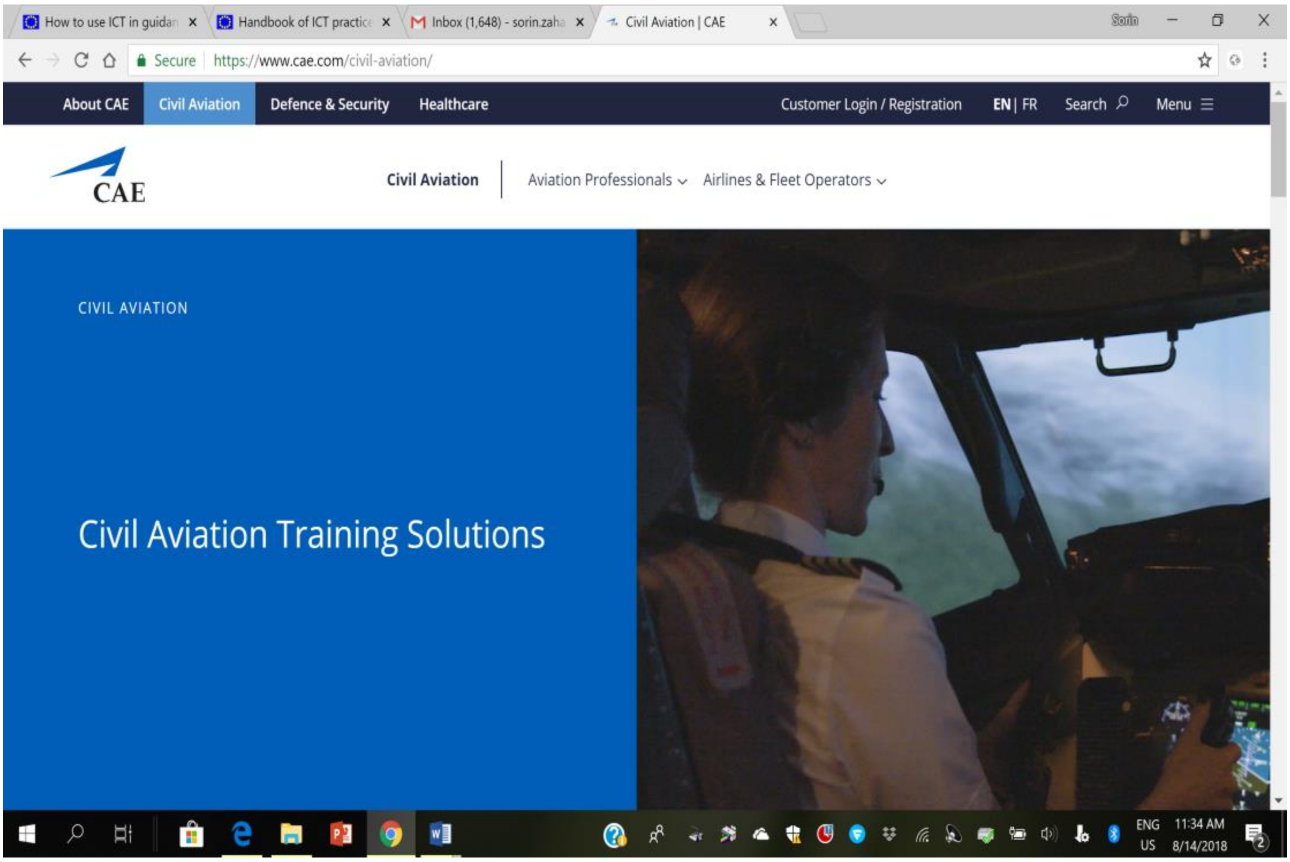

Figure 7.3 Civil Aviation Training Solutions platform
(source: http://www.cae.com/civil-aviation/)

The address of site is http://www.cae.com/civil-aviation/, or direct for careers, the address is https://www.cae.com/careers/.

Categories of trainings: Aviation professionals; Airline pilot training and Aviation jobs

They expertly match the skills and talents of aviation professionals worldwide with the specialised demands of a fast-growing aviation industry. They have over 1,400 Flight Crew and Technical Personnel on assignment with 70 clients in over 60 countries around the world. Additionally, they regularly place permanent staff in all areas of aviation within top aviation companies worldwide.

- **Business pilot training**
- **Maintenance training**
- **Cabin crew training**
- **Airlines & Fleet Operators:**
- **Training equipment**

With 70 years of experience, CAE knows the importance of having the right tools for effective training delivery. CAE's innovative XR Series training equipment suite, contains from ground school training solutions to full-flight simulators, and enhance the airline's operational excellence today.

Services: CAE offers training and recruitment services to enhance your operational excellence.

Training partnerships

Available aircraft platforms for training (https://www.cae.com/civil-aviation/available-aircraft-platforms-apt/)

With over 250 civil aviation full-flight simulators, CAE provides training on the widest coverage of in-production and in-service aircraft models in more than 50 global training locations.

7.2.2 Groupement Des Industries Françaises Aéronautiques et Spatiales (GIFAS)

GIFAS is the French Aerospace Industries Association created in 1908. Also, GIFAS is a professional federation that brings together nearly 400 companies - from prime contractors and system managers to SMEs. They constitute a coherent, solidary and dynamic high-tech sector specialized in the study, the development, the realization, the marketing and the maintenance of all aeronautical and space programs, civil and military: planes, helicopters, engines, drones, missiles, satellites and space launchers, large systems and equipment, defence and security systems, subsystems and associated software.

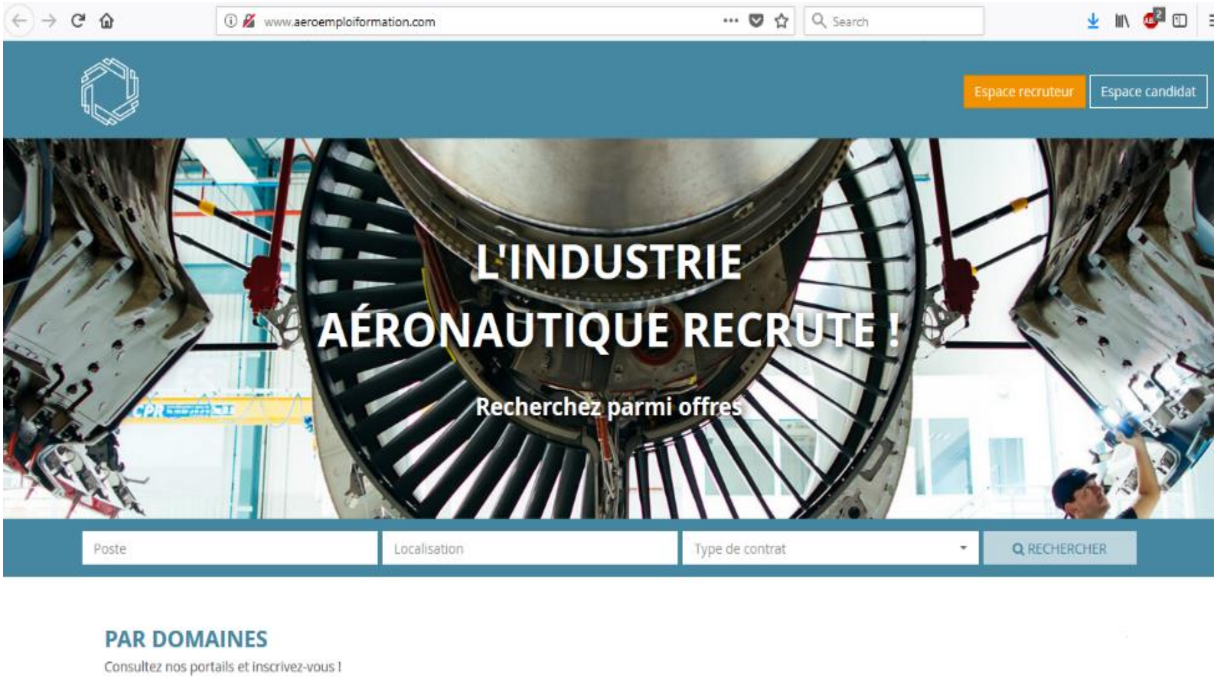

Figure 7.4 GIFAS platform
(source: http://www.aeroemploiformation.com/)

GIFAS has three major missions:

1. Representation and coordination

The GIFAS Board of Directors, comprising senior executives of member companies, draws up action guidelines to reflect the interests and concerns shared by its members. Actions are based on input provided by the association's specialist Commissions and the staff who implement the Board's decisions.

2. To analyse and defend the industry's interests

GIFAS critically examines all economic, social, financial, environmental and technical regulations likely to affect its members' general interests, whether proposed at French, European or international level. Its remit covers issues as varied as R&D, European Defence, transatlantic relations, support for SMEs, country intelligence for the sector, procurement contracts, the environment and sustainable development, security, certification and standardization, tax affairs, risk prevention and insurances.

3. To promote and train

GIFAS promotes the image of the French aerospace industry by:

– participating in international events and trade shows ;
– organizing exhibitions, trade and fact-finding missions;
– pro-actively distributing information to all media in France and abroad as well as to public and political bodies;
– organizing the International Paris - Le Bourget Air Show held every two years.

This platform offers a wide range of jobs in the airline industry, from which you can choose, depending on skills and places of availability. Many of the job options to find on this platform (GIFAS) are listed below. Figure 7.5. will illustrate how to get to those jobs easier.

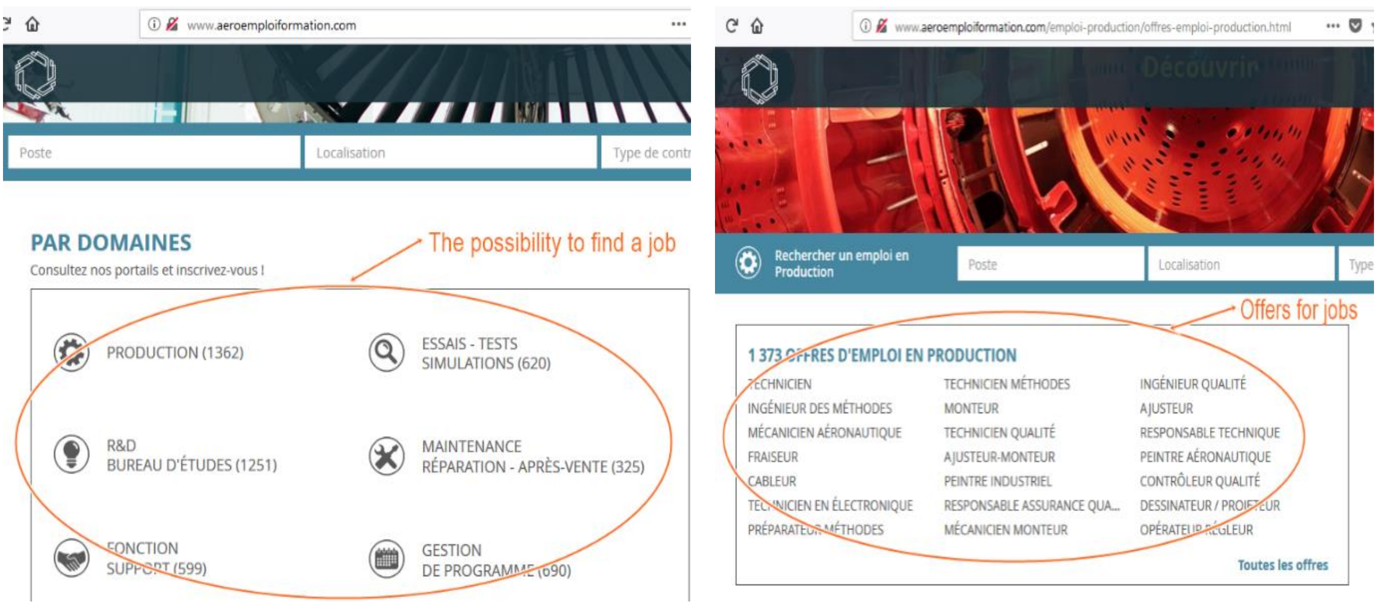

Figure 7.5 How to find job offers
(source: http://www.aeroemploiformation.com/)

Site address: https://www.gifas.asso.fr/fr/, while the careers webpage is: http://www.aeroemploiformation.com/.

Areas of employment displayed on previous site are present in the following Table 7.1:

Table 7.1 Areas of employment of GIFAS platform

Production (1 310 job offers)	**R & D Engineering office (1 156 job offers)**	**Support function (599 job offers)**	**Tests - Tests Simulations (582 job offers)**	**Maintenance Repair - After-Sales (319 job offers)**	**Program Management(659 job offers)**
Technician	Engineer	Buyer	Technician	Quality Engineer	Engineer
Quality Engineer	Methods technician	Quality Engineer	Quality Engineer	Maintenance technician	Project Manager
Methods technician	Quality Engineer	Methods Engineer	Quality technician	Mechanical engineer	Systems Engineer
Editor	Methods Engineer	Quality technician	Quality controller	Technician	Engineering study
Aeronautical mechanic	System Architect	Operator	Quality Manager	Mechanical engineer	Assistant engineer
Quality technician	Engineering study	Management control	Test technicians	Maintenance manager	Planner
Technical Manager	Software Architect	Quality Insurance Manager	Test Engineer	Maintenance mechanic	Project Manager
Aeronautical Fitter Adjuster	General engineering	Quality technician, control and measurement	Quality technician, control and measurement	Aviation maintenance technician	Development Engineer
Draftsman / Designer	Mechanical design engineer	Operator	Mechanical design engineer	Mechanical design engineer	Program Manager
Quality controller	IT Developer	Quality Manager	Quality inspector	Maintenance Technician	General engineering
Methods technician	Software Development Engineer	Operational safety engineer	Quality specialist / quality control	Industrial maintenance technician	Project director
Other	Other	Other	Other	Other	Other

(source: http://www.aeroemploiformation.com/)

7.2.3 International Civil Aviation Organization (ICAO)

The International Civil Aviation Organizations a specialized agency of the United Nations. It codifies the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth.

ICAO are always looking for energetic, passionate, motivated individuals to join their team. For career opportunities consult ICAO website.

The website provides information regarding the qualifications and experience needed to have a successful career as well as explaining the benefits of working at ICAO.

ICAO platform can help finding a job, based on each person's abilities described below. Figure 7.7. illustrates how easily someone can apply for a job.

Figure 7.6 ICAO Platform
(source: https://www.icao.int/Employment/HR/Pages/default.aspx)

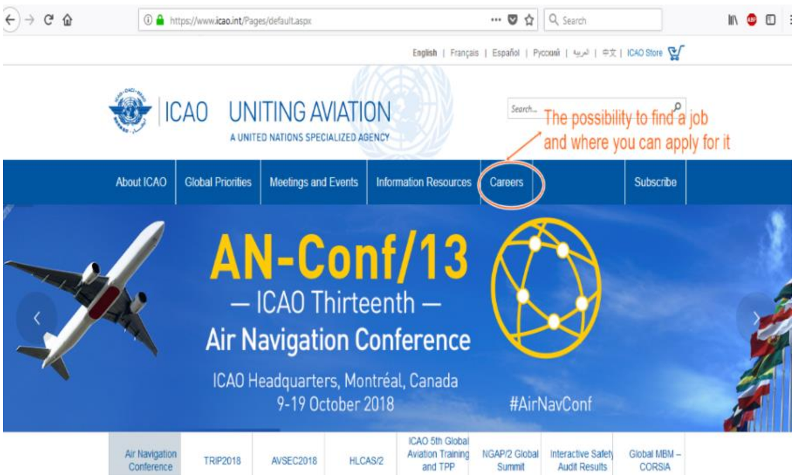

Figure 7.7 Where to apply for a possible job
(source: https://www.icao.int/Pages/default.aspx)

Site address: https://www.icao.int/Pages/default.aspx; while the careers webpage: https://careers-new.icao.int/web/icao/employment.

Technical Cooperation Programme Field Projects

ICAO's Technical Cooperation Programme roster of over 3,000 experts provides advice and assistance to Contracting States in a variety of tasks, such as; civil aviation master plans, air traffic control services, airport modernization, safety oversight, regulatory frameworks, MRTD's and e-Passports, and more. Experts typically work together with national specialists to transfer their knowledge and at the same time to provide on-the-job training.

The people they are looking for should:

- Demonstrate a high level of technical knowledge;
- Be motivated and have a strong commitment to the delivering our policies and programs;
- Possess good analytical skills and a keen interest in and an understanding of policy issues especially in the area of aviation;
- Be able to work well in a multicultural team;
- Have working experience at national and/or international level, in a field relevant to the International Civil Aviation Organization's work;
- Be proficient in English and have a working knowledge of at least one of the other official languages of the Organization (Arabic, Chinese, French, Russian and Spanish). Any additional languages will be regarded as an asset.

Recruitment Principles:

- They are committed to promote diversity in their workforce;
- They aim to achieve a broad representation of member country nationals with emphasis on developing countries;
- They are committed to improve gender balance across the Organization;
- They strive to provide an environment where the contribution of everyone is valued.

7.2.4 European Transport Workers' Federation (ETF)

The European Transport Workers' Federation (ETF) is a pan-European trade union organization which embraces transport trade unions from the European Union, the European Economic Area and Central and Eastern European countries.

Today, the ETF represents more than 5 million transport workers from more than 200 transport unions and 41 European countries. These workers are found in all parts of the transport industry, on land, sea and in the air. Transport workers cover the following sectors listed in Table 7.2

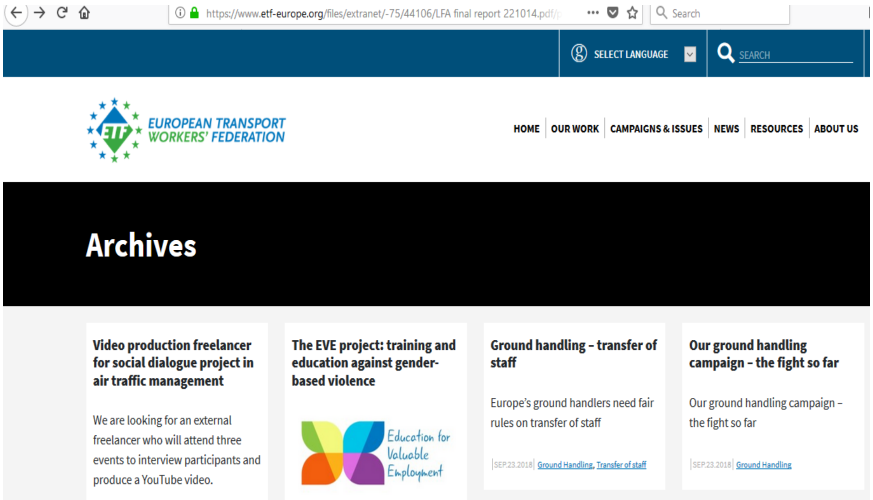

Figure 7.8 European Transport Workers' Federation Platform
(source: http://www.etf-europe.org/files/extranet/-75/44106/LFA%20final%20report%20221014.pdf)

Table 7.2 Sectors covered by transport workers

Civil aviation	Fisheries	Inland waterways
Logistics	Maritime transport	Railways
Ports and docks	Road transport	Tourism
Urban public transport		

(source: http://www.etf-europe.org/files/extranet/-75/44106/LFA%20final%20report%20221014.pdf)

They also have specific structures to represent women and young transport workers.

Site address: https://www.etf-europe.org/; while the careers webpage: is http://www.etf-europe.org/files/extranet/-75/44106/LFA%20final%20report%20221014.pdf

Available job: An external freelancer who will produce a YouTube video about the Toolbox for successful social dialogue in air traffic management (ATM) is needed. The external freelancer should be a communication professional that is able to deliver the best information. The information is described on the webpage.

7.2.5 Eurostat

Eurostat is a Directorate-General of the European Commission. Its main responsibilities are to provide statistical information to the institutions of the European Union (EU) and to promote the harmonization of statistical methods across its member states and candidates for accession as well as EFTA countries. The organizations in the different countries that cooperate with Eurostat are summarized under the concept of the European Statistical System.

Eurostat offers worthwhile, challenging and rewarding careers in the field of European statistics.

They seek to attract and retain highly motivated and competent people, with a wide range of skills and experience, from statisticians and economists to secretaries, from all regions of Europe.

Job offers and traineeships (some of which are listed below) can be found using the EUROSTAT platform. Figure 7.10. illustrates where to apply for jobs and traineeships.

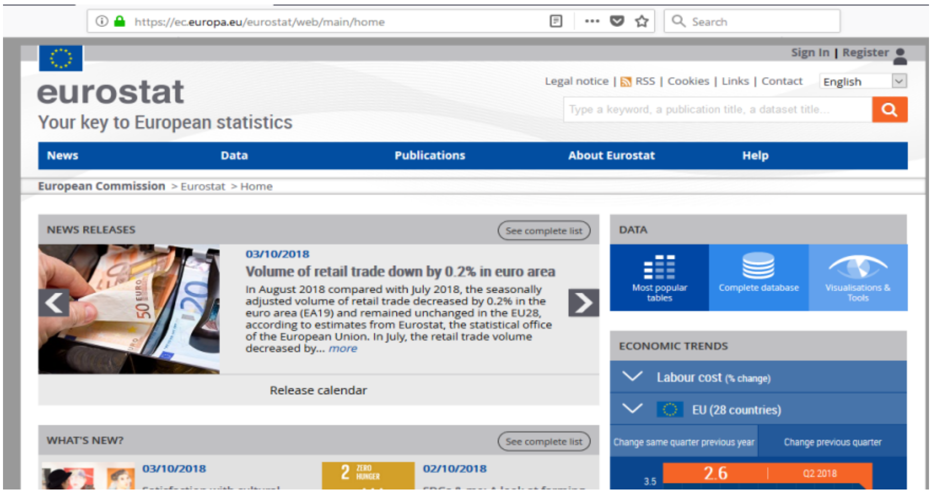

Figure 7.9 EUROSTAT Platform

(source: https://ec.europa.eu/eurostat/web/main/home)

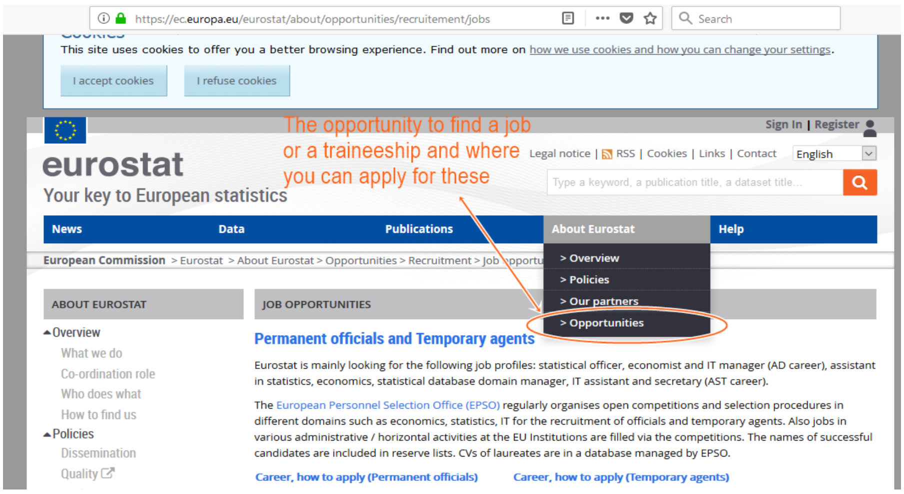

Figure 7.10 Where to find opportunities on Eurostat

(source: https://ec.europa.eu/eurostat/about/opportunities/recruitement/jobs)

Site address: https://ec.europa.eu/eurostat/web/main/home; and Careers webpage: https://ec.europa.eu/eurostat/about/opportunities/recruitement/jobs.

Eurostat is mainly looking for the following job profiles: statistical officer, economist and IT manager (AD career), assistant in statistics, economics, statistical database domain manager, IT assistant and secretary (AST career).

Traineeships are present in the following Table 7.3:

Table 7.3 Traineeships on Eurostat

Transport (E3)	Agriculture and fisheries (E1)
Labour market and lifelong learning (F3)	Excessive deficit procedure (EDP) 1 (D2)

(source: https://ec.europa.eu/eurostat/about/opportunities/recruitement/jobs)

Eurostat offers traineeships mainly in the fields of statistics, economics, and IT. The traineeship starts on 1 March and 1 October every year.

Students pursuing or coming to the end of the studies may be offered an unpaid traineeship at the European Commission.

7.2.6 Study.com

Study.com aim to deliver a better way to learn — the platform delivers courses depending on preferences and affordability.

Jobs in the airline industry include pilot, flight attendant, and aircraft mechanic. Becoming a pilot requires extensive training and usually a degree, and mechanics must attend technical college. Flight attendants can get started with just a high school education and receive training on the job.

Thanks to this platform, the probability of finding a job in the favorite field, especially in aviation, is much higher. So, below are listed available aviation jobs. Figure 7.12. illustrates how to easily access the platform and search the much-desired job.

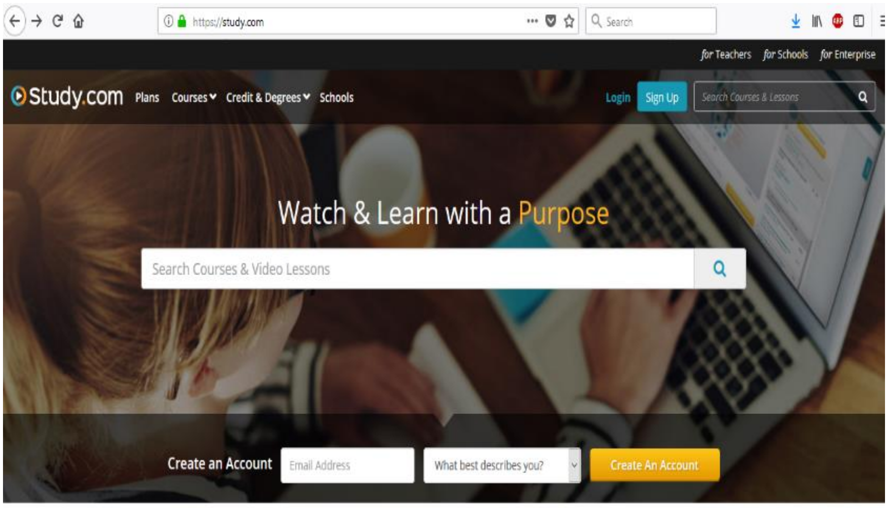

Figure 7.11 Study.com platform (source: https://study.com/)

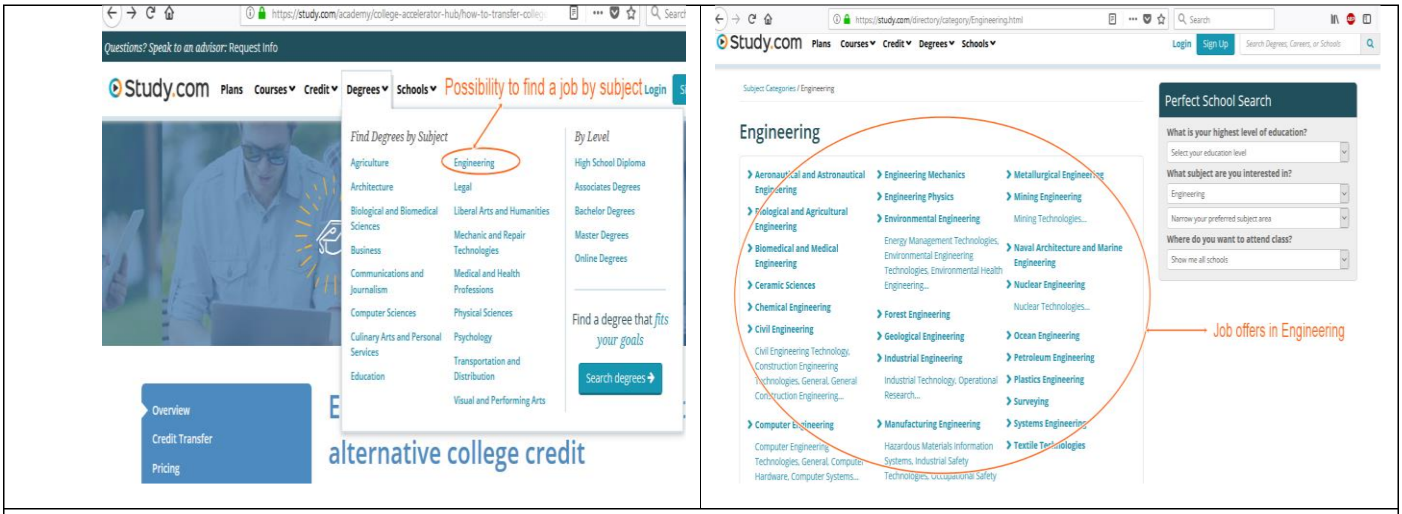

Figure 7.12 Engineering jobs opportunities (source: https://study.com/directory/category/Engineering.html)

Site address: https://study.com/; and Careers webpage:https://study.com/articles/Airline_Industry_Careers_Options_and_Requirements.html.

Airline Industry Careers Options:

- Commercial Airline Pilot:
  - Education Requirements - Military training, flight school or college degree
  - Other Requirements - FAA licensure, flying experience and physical fitness
  - Median Salary (2015) - $76,150*
  - Projected Job Growth (2014-2024) - 10%*
- Aircraft Mechanic:
  - Education Requirements - Technical school
  - Other Requirements - FAA licensure
  - Median Salary (2015) - $58,370*
  - Projected Job Growth (2014-2024) - 1%*
- Flight Attendant:
  - Education Requirements - On-the-job training and hands-on classes
  - Other Requirements - Customer service skills
  - Median Salary (2015) - $44,860*
  - Projected Job Growth (2014-2024) - 2%*

7.2.7 Academiccourses.com

Academic courses include a variety of post-secondary school programs that provide graduates with college or university-level academic qualifications. Some academic courses are designed to help bridge the gap between secondary school and university. Others are aimed at graduate- or post-graduate-level students, or working professionals. Some key types of academic courses include Foundation Courses, Preparatory Year, Certificates, Diplomas and Associates Degrees.

For prospective pilots, an aviation course is the way to initiate a long and successful career. This coursework includes a variety of essential training for pilots, including those seeking employment with commercial airlines and preparation for flight instructor programs. Courses cover a range of topics, from initiating the enrollment process to actual flight training. Students can gain access to keen insights from industry professionals, as well as learn more about practical flight knowledge.

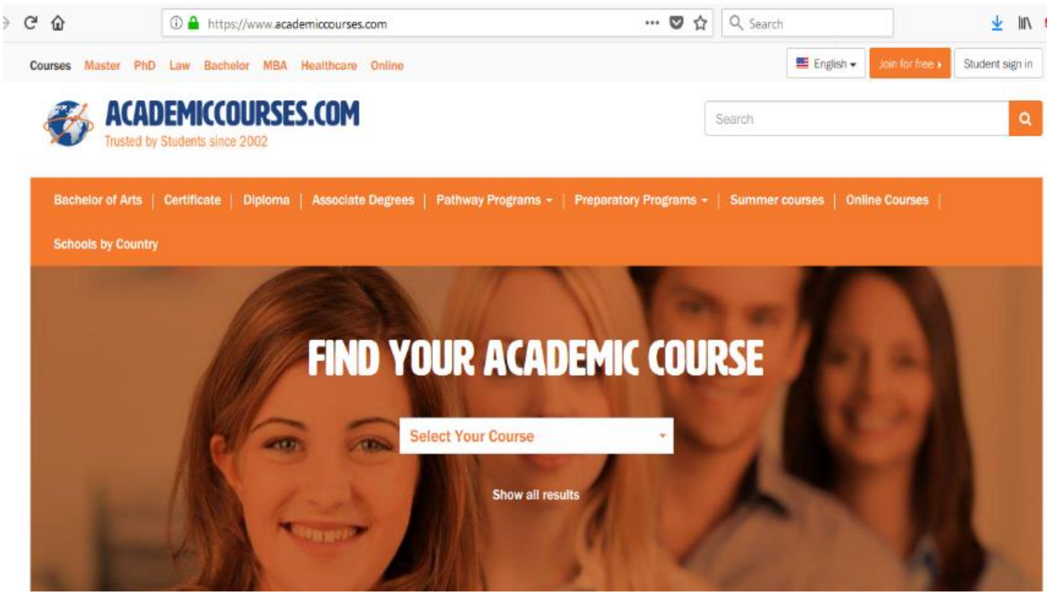

Figure 7.13 Academiccourses.com platform (source: https://www.academiccourses.com/)

With the Academiccourses.com platform various aviation courses are available to apply for. Below are listed aeronautical courses and what they offer.

Site address: https://www.academiccourses.com/;

Careers webpage: https://www.academiccourses.com/Courses/Aviation/.

Courses in Aviation displayed on previous site are present in following Table 7.4:

Table 7.4 Courses in Aviation listed by AcademicCourses.com

Aeronautical Engineering	**A course in aeronautical engineering can provide students with a more focused look at flight mechanics and how aircraft are designed.**
Aircraft Maintenance	This program includes a huge array of courses for participants to choose from that'll facilitate a better understanding of aircrafts and how they work with the weather and the people on board.
Air Traffic Control	These courses are designed to teach students the basics of arranging safe and efficient air traffic patterns.
Aviation Management	A class like this usually covers topics that are necessary to know in order to manage an aviation company.
Aviation Safety	Aviation systems require intense and rigorous safety regulations to reduce the risks involved with operating an aircraft.
Cabin Crew	It is a course that teaches young professionals how to work as expert crew members airplanes, and students may receive a certificate upon completing their studies.
Civil Aviation	These courses are typically designed for those who already hold a commercial pilot's license and may include classroom lessons and lectures and jet simulator training across several sections as well as development and training.
Flight Instructor	Flight instructor courses offer step-by- step, comprehensive instruction in manning different types of aircraft, most notably single-engine planes.
Helicopter Training	Whether you have aspirations to be a career helicopter pilot or just want to make flying a new standards.
Pilot Training	This field of study is taught all over the world to goals set by international hobby, private pilot helicopter training courses are often a good place to start.
Transport Aviation	This courses are designed to introduce students to the fundamentals of air transportation systems and beyond.

(source: https://www.academiccourses.com/Courses/Aviation/)

7.2.8 Cranfield University

Cranfield University is a British postgraduate and research-based public university specializing in science, engineering, technology and management.

Designed to offer the skills required to pursue a successful career in various sectors of the air transport industry including airlines, airport companies and authorities, civil aviation departments, air transport consultancies and aerospace companies. Strong industry links and success in placing graduates in this sector for over 50 years.

This platform offers courses to learn about different areas, especially aviation, but some jobs opportunities are also available. Figure 7.15. illustrates where to find online courses and jobs opportunities.

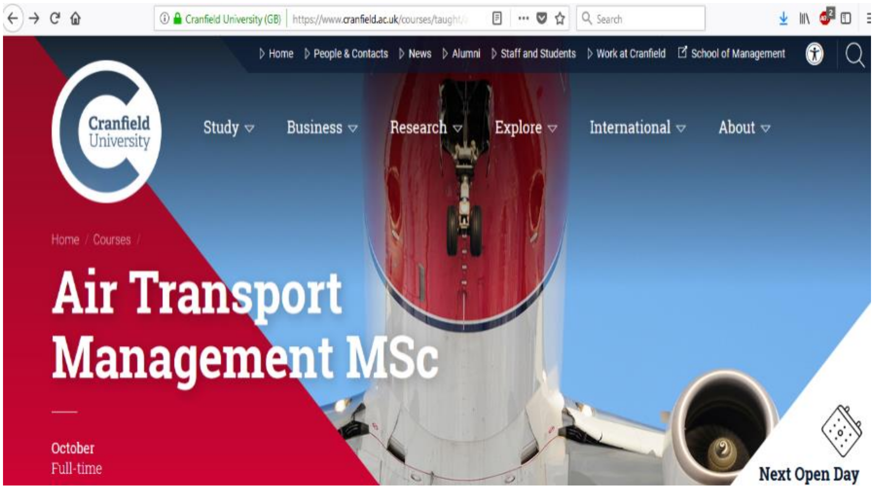

Figure 7.14 Cranfield University platform
(source: https://www.cranfield.ac.uk/courses/taught/air-transport-management)

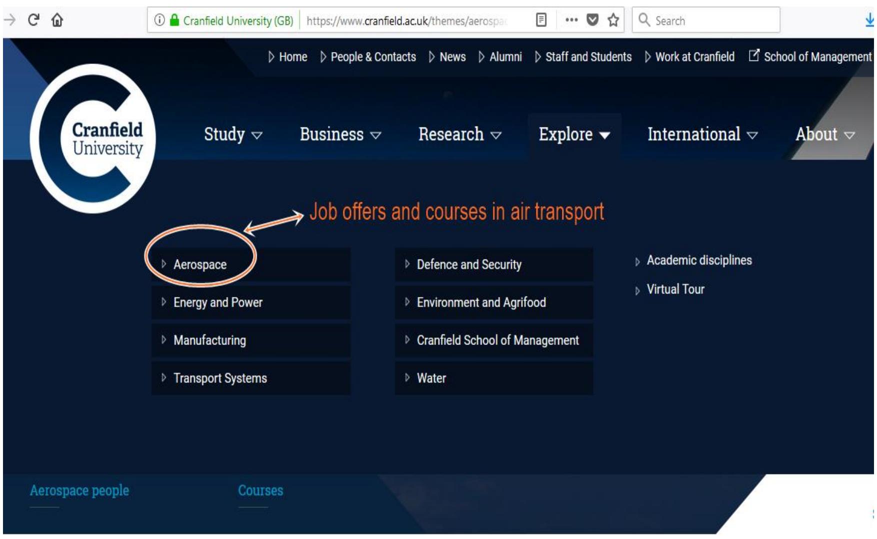

Figure 7.15 Job offers and courses in air transport
(source: https://www.cranfield.ac.uk/themes/aerospace)

Site address: https://www.cranfield.ac.uk/;

Careers webpage: https://www.cranfield.ac.uk/courses/taught/air-transport-management.

Table 7.5 Compulsory modules and their aims

Module	Aim
Air Transport Market Analysis and Forecasting	Obtain the theory and knowledge, skills of 'demand forecasting', and apply to the practical work for the air transport industry
Research Methods and Statistics	To facilitate the use of basic research methods and fundamentals of statistical analysis to solve research problems in the air transport industry
Applications of Air Transport Economics and Finance	To provide awareness of how economic and financial theoretical concepts are integrated and applied to decision-making in the air transport industry.
Air Transport Marketing	To provide students with knowledge, understanding and skills in airline marketing.
Air Transport Operations	To provide students with knowledge, skills and understanding in the theory and applications of aircraft and airline operations, engineering and maintenance to appreciate the impacts these have on the commercial activities of operators.
Air Transport Strategic Management	To give the tools needed to perform a detailed Strategic overview of an Airline.
Introduction to the Air Transport Industry	To introduce the air transport industry and an appreciation of the business and operational challenges faced by its key components
Regulatory Policy and Air Law	To provide a sound comprehension of how legal concepts and regulatory policies affect and apply the air transport industry, considering its unique nature.
Theory of Air Transport Economics and Finance	To provide a sound comprehension of how economic theories and financial concepts relate and apply to the air transport industry, considering its unique nature.

7.2.9 Ecole Nationale De L'aviation Civile (ENAC)

ENAC is internationally recognized as the leading aeronautics and aviation university in Europe, providing a broad range of training, studies and research activities.

This platform has different aeronautical programs available for application (check the list below). Figure 7.16 illustrates the platform's programs and where to easily access them.

Figure 7.16 Ecole Nationale de l'Aviation Civile platform (source: http://www.enac.fr/en)

Figure 7.17 Different programs to apply (source: http://www.enac.fr/en/study-enac)

Site address: http://www.enac.fr/en;

Programs webpage: http://www.enac.fr/en/study-enac.

Programs displayed on previous site are present in the following Table 7.5:

Table 7.6 Programs at Ecole Nationale De L'aviation

Type	Diploma
Advanced Masters	ENAC graduate engineer
Masters of Science	Advanced Technician Degree in Aviation (TSA)
Air Traffic Controller (ATCo)	Handling Agent / Flight Dispatcher (TAE)
Air Traffic Safety Electronics Personnel (ATSEP)	Pilot training

(source: http://www.enac.fr/en)

7.2.10 Airsight

Airsight is an experienced and well-established company providing airports, air navigation service providers as well as civil aviation authorities and organizations with consulting, engineering and aerial services, software and training.

Airsight offers a variety of practical training sessions, providing up to date content on a broad range of aviation topics conducted by renowned aeronautical experts.

Airsight platform offers a variety of courses to apply for. These courses take place at a certain time of the year. The period can be found by accessing that platform.

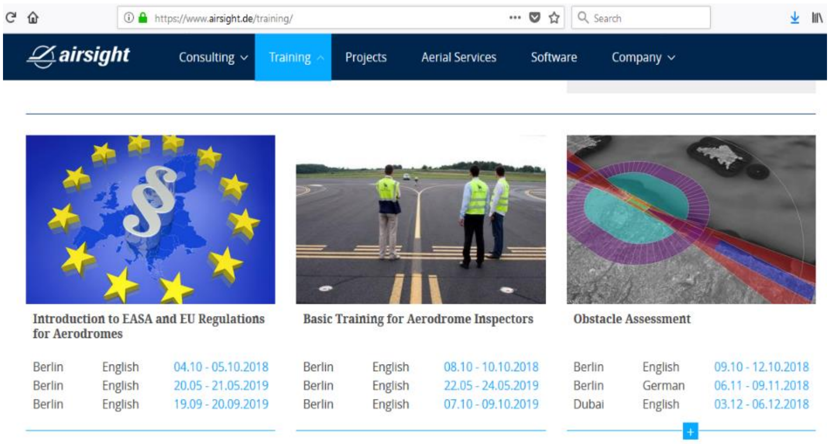

Figure 7.18 Airsight platform
(source: https://www.airsight.de/training/)

Site address: https://www.airsight.de/;

Training webpage: https://www.airsight.de/training/?gclid=CKDLms7mo9ICFcG6GwodgUkArA.

Some of the Course Programs (as of 04.10.2018) displayed on previous site are present in the following Table 7.7:

Table 7.7 Course Programs on Airsight platform

Introduction to EASA and EU Regulations for Aerodromes	**Basic Training for Aerodrome Inspectors**
Aerodrome Pavement Design and Management	Obstacle Assessment
Human Factors at Aerodromes	Safety Assessments at Aerodromes
Heliport Planning and Design (ICAO Annex 14 Volume 2)	Introduction to Airport Operations
Compliance Management at Aerodromes	Change Management at Aerodromes
EU/EASA Management Systems for Aerodromes	Flight Operations
Declaring Runway Distances and Displacing Thresholds	Introduction to Air Traffic Management

(source: https://www.airsight.de/training/)

This platform offers a variety of courses. Some of these are held in Berlin and others at home. The courses are available in English or German.

7.2.11 International Civil Aviation Organization (ICAO) – Global Aviation Training

The Global Aviation Training Office (GAT) aims to lead Human Resources Development strategies established by Member States and the aviation community to ensure access to a sufficient number of qualified and competent personnel to operate, manage and maintain current and future air transport system at prescribed international standards for: Aerodromes; Training Competency Development; Air Navigation Services; Security and Facilitation; Air Transport; Environment; Flight Safety and Safety Management.

Figure 7.19 ICAO – Global Aviation Training platform
(source: https://www.icao.int/Training/Pages/default.aspx)

Site address: https://www.icao.int/Pages/default.aspx;

Training webpage: https://www.icao.int/Training/Pages/default.aspx.

GAT platform offers training courses to apply for. Figure 7.20 provides instructions on how to access training courses faster.

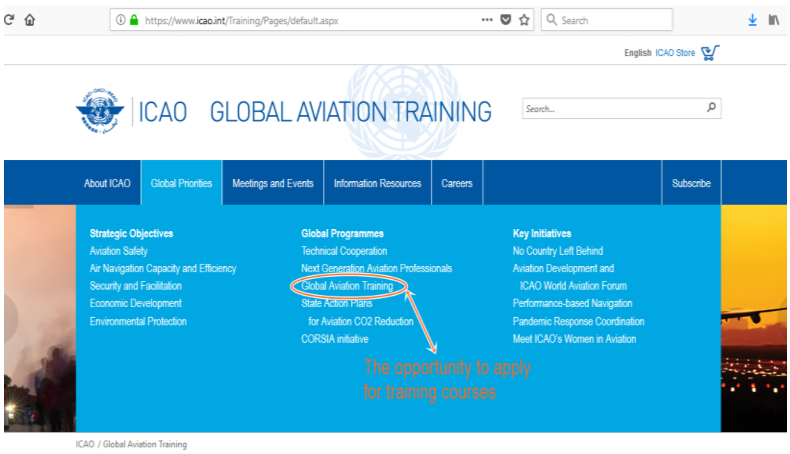

Figure 7.20 Opportunities for training courses
(source: https://www.icao.int/Training/Pages/default.aspx)

7.2.12 Airports Council International (ACI)

Airports Council International (ACI) is the only global trade representative of the world's airports. Established in 1991, ACI represents airports interests with Governments and international organizations such as ICAO, develops standards, policies and recommended practices for airports, and provides information and training opportunities to raise standards around the world.

ACI platform provides the opportunity to find an aeronautical training program. The courses available on the website are listed below. Figure 7.21 presents opportunities to be found on ACI platform.

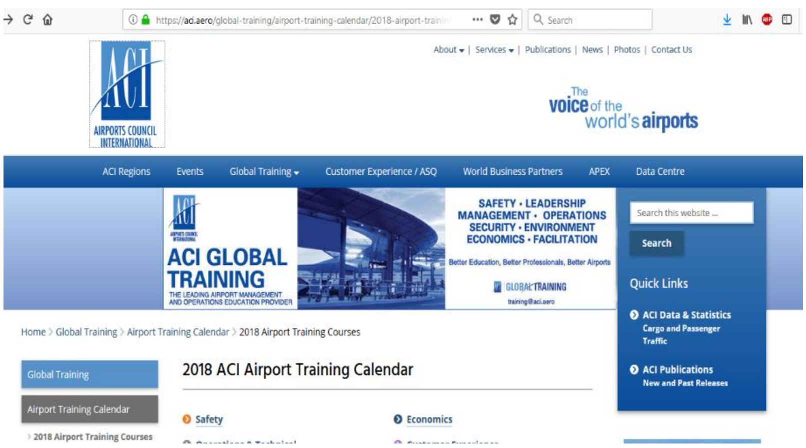

Figure 7.21 Airports Council International platform (source: https://aci.aero/global-training/)

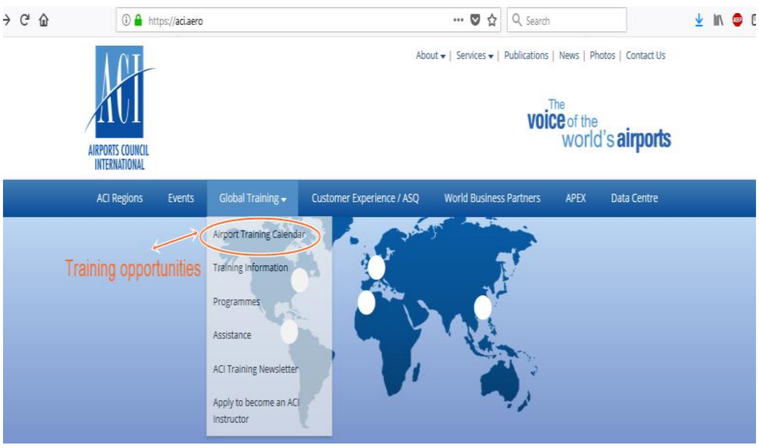

Figure 7.22 Training opportunities in aeronautics (source: https://aci.aero/global-training/)

Site address: https://aci.aero/;

Training webpage: https://aci.aero/global-training/airport-training-calendar/2018-airport-training-courses/.

Courses displayed on previous site are present in the following Table 7.7:

Table 7.8 Courses on Airports Council International platform

Safety	**For example -** GSN 4: Working with Annex 14: **This course provides airside safety personnel and planners who have already gained a basic knowledge of airport operations and aerodrome design and who will be required to implement the Standards and Recommended Practices contained in ICAO Annex 14 either through their Safety Management System or as part of new aerodrome development.**
Operations & Technical	
Leadership & Management	
Security	For example - **Airport Security Operations:** The ACI Airport Security Operations course provides students with an in-depth understanding of the role that the airport plays in aviation security and identify measures that are appropriate to participants' threat environment.
Economics	
Customer Experience	
Environment	For example - **Airport Environmental Management:** This course provides the essential background to manage airport sustainably. It addresses important aspects of sustainability and environmental management issues at an airport.

(source: https://aci.aero/global-training/airport-training-calendar/2018-airport-training-courses/)

7.2.13 Aviationjobsearch.com

On Aviationjobsearch.com platform wide variety of aeronautical jobs and courses can be found. Figure 7.24 exemplifies where to find jobs and courses on the platform.

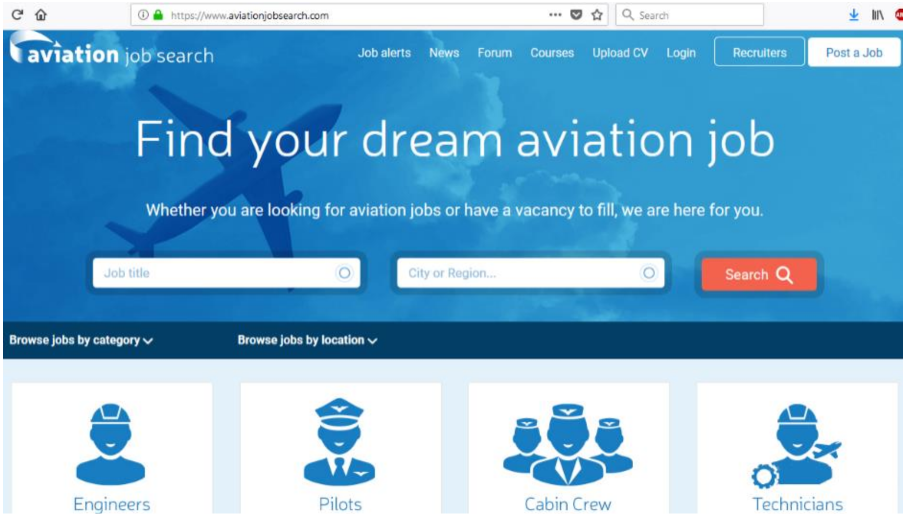

Figure 7.23 Aviationjobsearch.com platform (source: https://www.aviationjobsearch.com/)

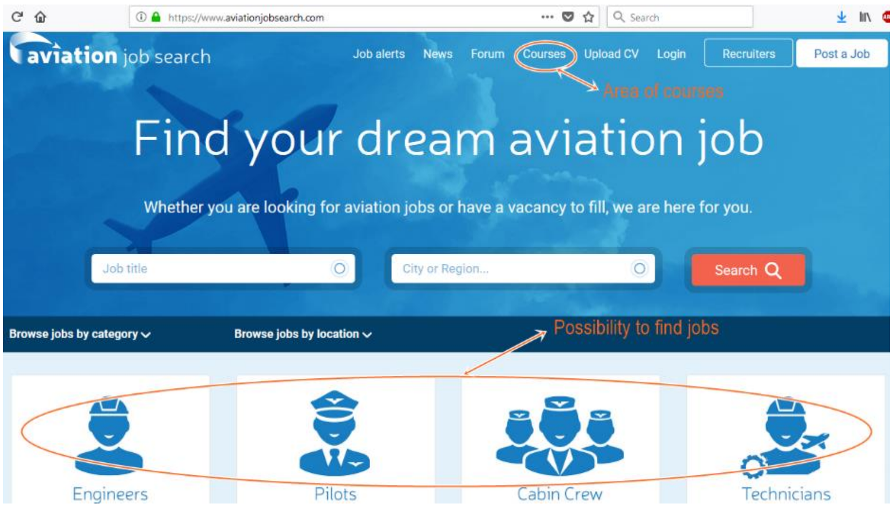

Figure 7.24 Jobs and courses webpage (Source: https://www.aviationjobsearch.com/)

Site address: https://www.aviationjobsearch.com/;

Careers webpage: https://www.aviationjobsearch.com/.

Areas of employment displayed on previous site are Aircraft & Aerospace, Engineering, Cabin Crew, Technicians and Pilots.

7.3 Augmenting the Next Generation of Aviation Professionals by Training with Holograms

The Next Generation of Aviation Professionals (NGAPs), who are entering the aviation industry today, represent a new generation of learners. To engage and meet their needs, the aviation community has been harnessing innovative technologies to look beyond tradition training methods and enhance workforce practices. (*Lori Brown (Lori Brown Mar 26, 2018) is the ICAO Next Generation of Aviation Professionals programme Outreach Chair, a member of the International Aviation Pilot Association (IPTA) outreach workstream, a Professor and researcher at Western Michigan University, College of Aviation and a Fellow of the Royal Aeronautical Society. She is an Airline Transport Pilot and has trained Ab-initio cadet pilots for Delta Airlines, British Airways, KLM, and UAE, as well as pilots for national and international government agencies.)*

One technology which is increasing in popularity and aviation use is the integration of mixed reality (MR) using holograms and digital computing headsets. Although virtual and augmented reality (AR) are not new overlay digital content in our real-world environment and promises to transform the way we train NGAP to operate and maintain aircraft. This can provide a mobile cost-effective solution to enhance real-world environments, create virtual simulations, accelerate learning and increase retention.

The operation and maintenance of modern aircraft calls for an understanding of several interrelated human and machine components that require practice and immersion. This immersive experience can be created or enhanced with augmented reality (AR) or virtual reality (VR). Relevant to the task-at-hand, they both have the ability to engage NGAP, allowing the student to practice, give real-time feedback, improve the efficiency of skills transfer and increase knowledge retention. Where they differ, is the perception of our presence, the ability to work untethered, and the ability to train crews.

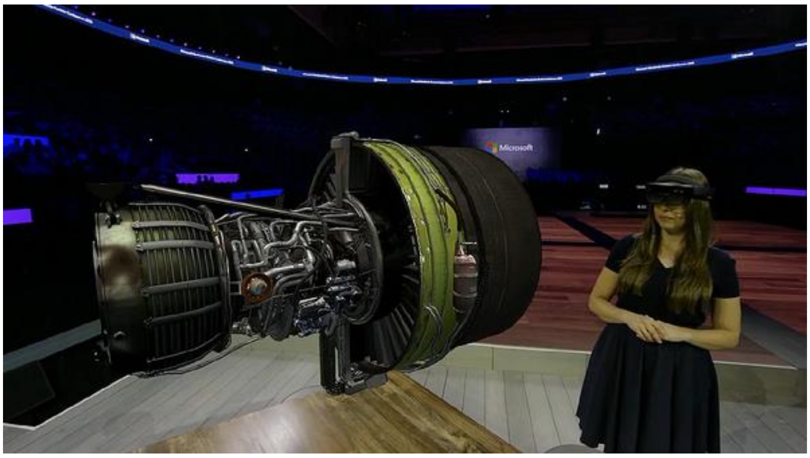

Figure 7.25 Japan Airlines HoloLens turbofan engine maintenance training (source: https://www.unitingaviation.com/strategic-objective/capacity-efficiency/augmenting-aviation-training-with-holograms/)

Virtual reality (VR) is able to transpose the user through closed visors or goggles, which block out real-world surroundings. VR can be useful for singular operations, such as reviewing a special qualification airport to allow the pilot to experience the terrain and surroundings before actually flying the approach; learning a procedure or checklist; and practicing maintenance or other operational functions. On the other hand, MR blends virtual reality content with the real-world and allows the user to interact with the content using hand gestures or voice commands.

Most significant for aviation training, is the fact that—unlike with VR—the user is not shut away from their surroundings with mixed reality. Whether or not you happen to be sharing a physical space, mixed reality allows you to see, listen, and talk to others while everyone involved sees the same holograms simultaneously. As a result, users can interact with virtual content while continuing to be in touch with the real life around them.

Operational tasks (such as aircraft maintenance) can also be augmented with procedures, checklists and manual information to create a hands free environment.

This experience is achieved by wearing MR headsets like the Microsoft HoloLens. MR adds interactive computer-superimposed holographic enhancements to a user's real-world environment. This technology also allows for remote instruction for crews and maintenance technicians, which could be a game changer for the entire industry.

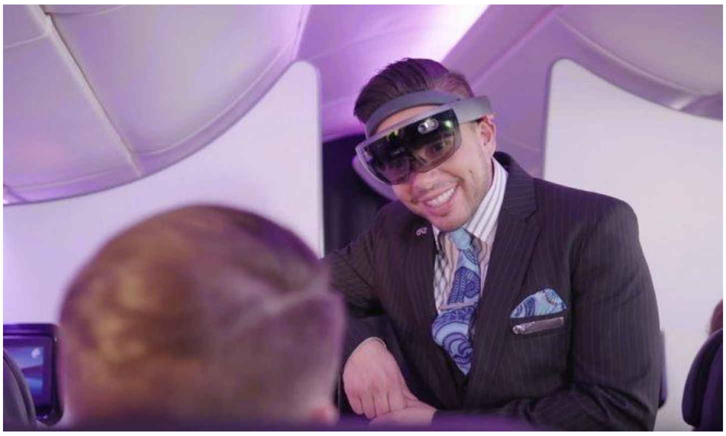

Figure 7.26 Air New Zealand using HoloLens to enhance the customer experience (source: https://www.unitingaviation.com/strategic-objective/capacity-efficiency/augmenting-aviation-training-with-holograms/)

The application was developed for aviation operations and procedures training (normal and abnormal) for the CRJ-200 regional jet, B787, A380 and SR20 aircraft, to bridge the gap between classroom and flight simulation; engage NGAP; and allow students to practice in a fully immersive environment. The interactive JetXplore application includes customized scenarios, turbofan engines and 360-degree interactive cockpits to teach aircraft systems, flows, checklists and allow students to practice quick reference handbook (QRH) malfunctions. Beyond customizing the JetXplore application for the virtual environment, a significant goal of this project is to explore subjective presence as it affects task performance, to reduce the gap between expensive simulators and the classroom.

Figure 7.27 Mixed Reality technology and devices like the Microsoft HoloLens are transforming aviation training and operations for the next generation workforce
(source: https://www.unitingaviation.com/strategic-objective/capacity-efficiency/augmenting-aviation-training-with-holograms/)

The pedagogical material development has been extended to outreach activities and integrated AR micro-simulations in the classroom as interactive 3D knowledge objects. Using Bloom's Taxonomy in the cognitive domain, 3D learning objectives can be refined to create more meaningful student outcomes, and

mapped to reflect expected assessment and student proficiency in technology-driven training environments.

The Microsoft HoloLens MR devices and immersive headsets are at the forefront of immersive technologies and, rather than replace existing simulators, it can enhance them. Engaging with the holograms by walking around, interacting and even modifying them, can lead to higher motor excitability and increased working muscle memory. We can safely simulate dangerous or difficult to replicate scenarios; require trainees to actively participate in exercises; evaluate based on performance or relevant tasks with data transmitted to a company's training department or instructor; virtually create new equipment without expense or space-accommodating additions, and allow training anywhere, any time, with MR headsets.

With this in mind, it can be suggested that MR offers the potential for deeper knowledge retention in aviation training, while actively engaging NGAP.

Unlike other advanced technologies, HoloLens is intuitive and offers a natural means of interaction. There's no mouse, wire or touch-screen. All you need are simple gestures to create and alter holograms, your voice to communicate with apps, and your eyes to navigate and analyze. The JetXplore application allows students to use the real movements in the flight deck when interacting with push buttons, toggles, dials or thrust levers, to ensure no negative training is taking place and improve muscle memory.

Technologies like these bring forth a new medium for aviation training, a new paradigm of mixed reality. For the first time, we have the ability to take the analog world and superimpose digital artifact, creating mixed reality aviation simulations. Instructors can be anywhere and trainees can bring extremely realistic holographic images of say, a giant B787, A380 or turbofan engine directly into their home, training facility, school, university, or anywhere else training is taking place, which allows them to interact with the object to learn and practice procedures, preflight actions and other information needed to operate or maintain equipment.

While not everyone has the luxury of having technologies like the HoloLens in the classroom, most of us do have a smart phone. With image recognition technology we are able enhance our current and future print media and 'overlay' our own experiences such as checklist, 3D models, video, procedures or interactive training modules. This is similar to an invisible QR code which is mapped to a corresponding image or URL. Currently, WMU Professor Lori Brown and colleagues at Purdue are creating an aircraft systems textbook with augmented reality overlays to allow students to interact with the images in the textbook. The students simply download the application (similar to a QR code reader) and use the camera in their phone or tablet to see the hidden content.

This technique can also be used by airlines and training providers to overlay content, such as video of procedures or flows over checklists or manual information. Furthermore, the process benefits from the advantage of 3D. Aviation training can break free of 2D limitations, making it easier for people to visualize a finished project, reduce design errors, save time, and allow facilities to open faster.

Companies that rely on engineers and technicians in their workforce also stand to benefit greatly from the immersive potential of AR and MR. As this potential becomes more and more realized, engineers both operationally and from a training perspective may see their entire industries transformed by mixed reality. Where the traditional aviation training model leans heavily on memorization, the educational system is shifting the focus from what students learn to how well students can apply knowledge. As we redefine the aviation training environment through technology and innovation we can prepare NGAP to meet current workplace expectations and prepare for the challenges of tomorrow.

8 Methodology for Sectorial Qualifications Framework for Air Transport

8.1 Sectorial Qualification Framework for Air Transport (SQFAT) Components

The identity of the SQFAT is shaped by 10 components, structured on 3 levels (Fig. 8.1):

A. Determining factors and processes for qualifications development (components 1, 2, 3, 4 and 5);
B. Description and recognition of qualifications (components 6, 7 and 8);
C. Impact on the training process, on one hand and on social development and innovation and quality of life, on the other hand (components 9 and 10).

The 10 components create a unitary whole where each component builds upon the value and functions of the others.

1. The aviation overview component:

The SQFAT design and implementation involve:

- analysis of the state of the art of air transport industry qualifications;
- analysis of the existing methodologies for SQF and aviation regulations on regulated qualifications and methodologies for recognition of prior learning or work experience;
- links with social development projects, meeting the requirements of the knowledge society, lifelong learning and labour market.

In the development of the SQFAT there is a focus on ensuring compliance with the European and national policies on qualifications description. SQFAT is developed so that it does not only allow for adaptation to the dynamics of existing occupations and professions in the air transport sector, but also for the anticipation or forecasting of new ones.

2. The conceptual component includes the concepts and principles underlying the SQFAT design and implementation (see: 8.3.1 - 8.3.3). They provide the theoretical basis for the methodological-instrumental component.

3. The methodological component includes the conceptual matrix and the tools used to analyze and describe qualifications (see: 8.3.4).

4. The assessment component encompasses the system of assessment types and procedures used for qualification levels 5, 6, 7 and 8. The minimum performance standards provided to demonstrate each competence defining the respective qualification are of outmost interest.

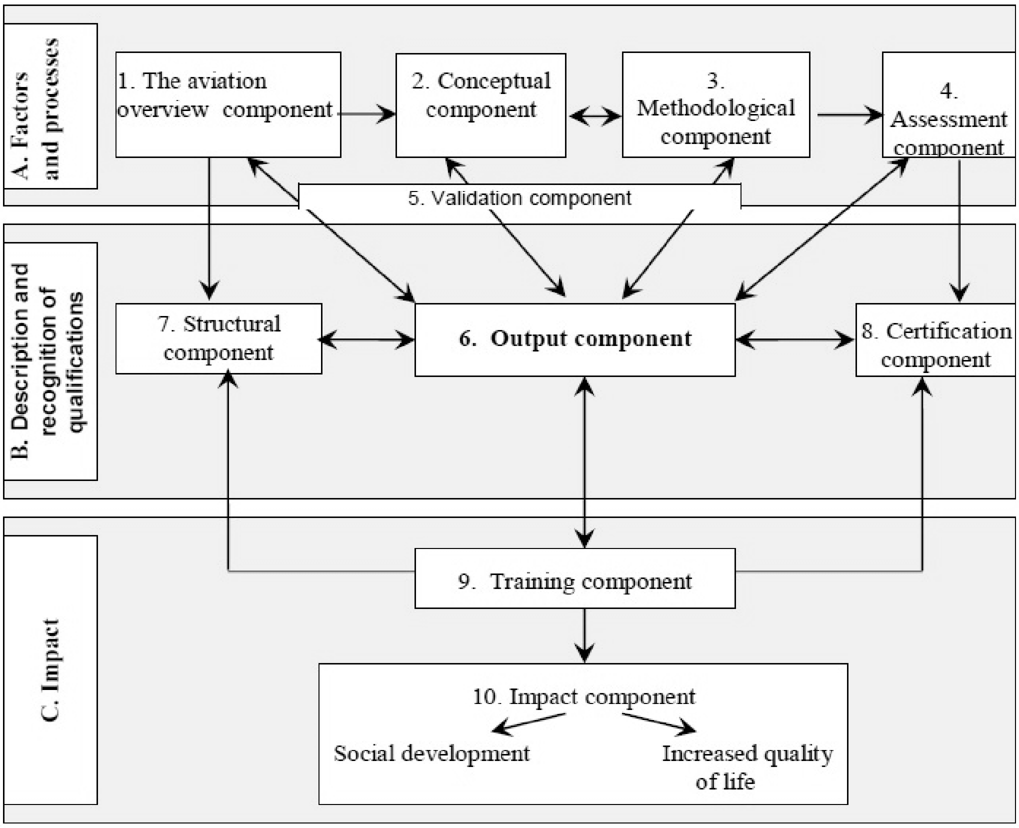

Figure 8.1 The ten components of the SQFAT and their interlinkages
Source [72]

5. The validation component means that the designed SQFAT is subject to various subsequent analyses and evaluations.

6. The output component is illustrated by the types of qualifications and their correlations according to fields and to the four levels of qualification indicated above.

7. The structural component, in line with EC recommendations, focuses on four of the eight levels of qualification, namely: level 5, Bachelor university studies, corresponding to EQF level 6, Master's university studies, corresponding to EQF level 7, and level 8, corresponding to doctoral studies.

8. The certification component includes four categories of procedures:

Development of relevant documents for validation of a school/university qualification, by the school/university study programmes providers;

Qualification evaluation and accreditation procedures – by relevant bodies;

Registration and updating procedures for the SQ Register or National Qualifications Register;

Ensuring compatibility with the European Qualifications Framework for lifelong learning as well with ATS regulation.

9. The training component is based on the qualification's descriptions and the related curriculum documents (curricula, course syllabus) and it relies on principles and strategies allowing the specification of competences defining each qualification.

10. The impact component evaluates qualifications designed and developed. The evaluation of impact takes into account both the contribution of qualifications to the social development and innovation and the effects on personal development and on the improvement of quality of life.

Figure 8.1 highlights, as well, the relationships between the ten components. The output component (6) holds a core position as the types of qualifications are developed firstly based on the social, political, technological and cultural component (1), on the conceptual-theoretical component (2), on the methodological-instrumental component (3), on the assessment component (4) and on the validation component (5) and, simultaneously, on the qualification levels provided by the structural component (7). Component 8 (certification) aims at the social/national/international recognition of a qualification.

8.2 Structure of the Sectorial Qualification Framework for the Air Transport

Structure of the Sectorial Qualification Framework for the Air Transport (SQFAT) describes the qualifications corresponding to four qualifications levels:

Table 8.1 SQFAT describes the qualifications corresponding to four qualifications levels

Tertiary education levels	EQF qualifications levels
Tertiary non-university/ univ. short studies	5
Bachelor university studies	6
Master university studies	7
Doctorate university studies	8

Each qualification shall be defined by means of learning outcomes expressed in terms of knowledge, skills, autonomy and responsibility and social and personal development, related to each level of studies.

In the description of the qualifications, one important factor shall be considered: the professional activity involves several competences with varying complexity: professional competences and transversal competences.

8.3 Conceptual Basis

8.3.1 Key Concepts

The key concepts used in designing SQFAT are: qualification, learning outcomes, knowledge, skills, autonomy and responsibility, and competence.

Qualification means a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards [26].

Thus, the qualification is the formal acknowledgement of the value of the individual learning outcomes for the labour market, as well as for the continuing education and training, by means of a study document (diploma, certificate or attestation) awarding the legal right to practice a profession / trade.

Learning outcomes means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of three domains: knowledge, skills and responsibility and autonomy [26].

Thus, the learning outcomes are the set of knowledge, skills, attitudes (responsibility and autonomy) a person has acquired or is able to demonstrate upon completion of the learning process during a certain educational cycle.

Knowledge means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and / or factual [26].

Skill means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments) [26]. Skills include certain types of operating structures, from dexterity to interpretation and problem-solving capacities.

The third domain of the learning outcomes is “Responsibility and autonomy”. According to EQF-2017, “*Responsibility and autonomy means the ability of the learner to apply knowledge and skills autonomously and with responsibility” (Annex I)*

Competence integrate all these domains of learning outcomes in order to solve with success a certain working or learning task, in each context [58]. For an integrated model of “competence” see figure 8.2.

In the definition of EQF, *“competence means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development*”.

Each type of learning outcomes has its own autonomy, indicates distinct training aims, specialised training processes and specific assessment processes. There is an interdependence relationship between the three types of learning outcomes [58] and, at the same time, a hierarchy in the process of acquiring these outcomes, namely: certain types of knowledge underpin skills and a certain combination of knowledge and skills leads to the development of a competence (see: Fig. 8.3).

8.3.2 Categories of Competences

Competences can be classified in two categories (Fig. 8.3):

1) professional competences;

2) transversal competences.

By **professional competence** we understand the proven capacity to select, combine and use adequately knowledge, skills and other attainments (such as values and attitudes) which are specific to a professional activity in order to solve successfully problem situations related to the respective profession, effectively and efficiently.

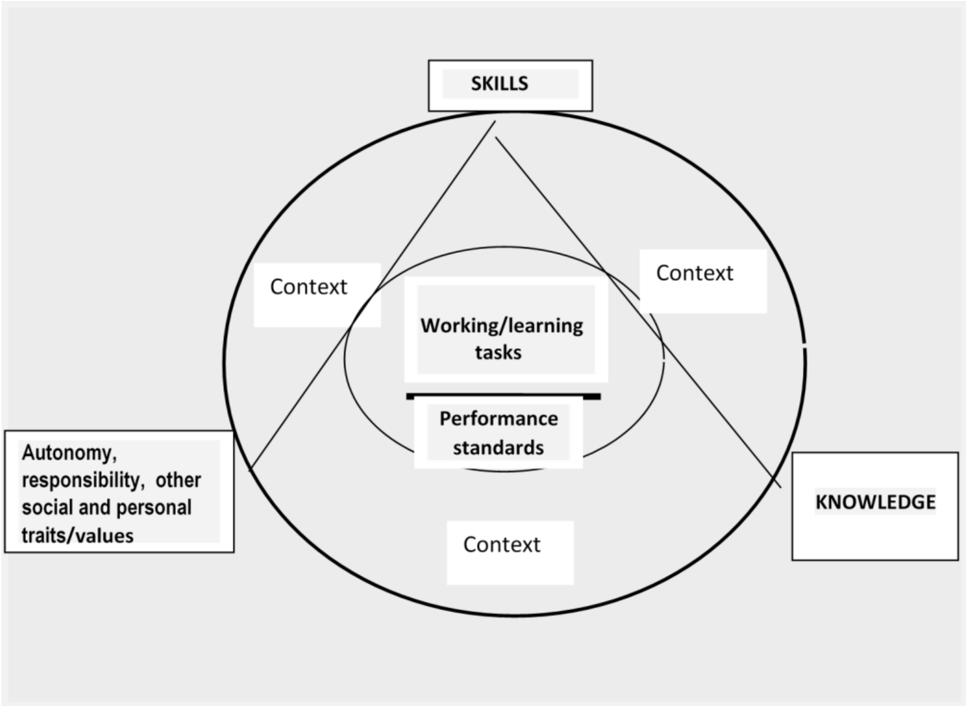

Figure 8.2 Competence in terms of learning outcomes
Source [58]

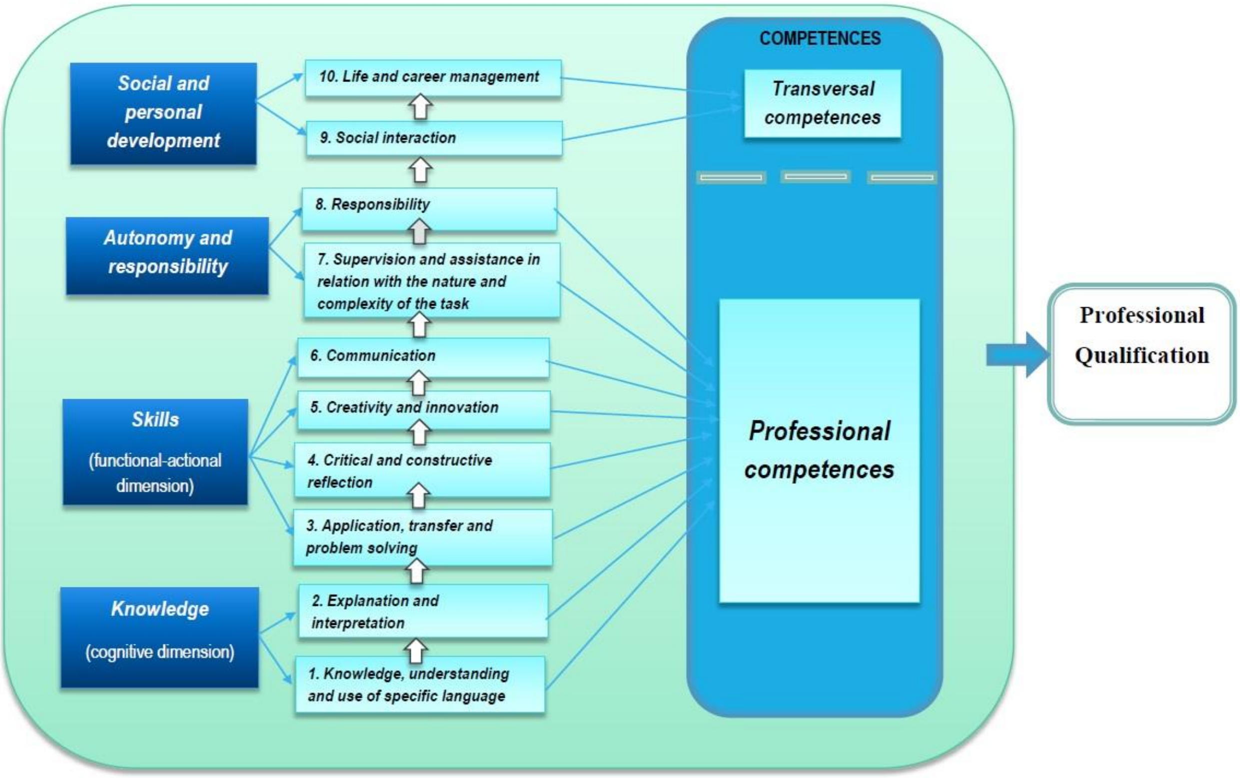

Figure 8.3 Learning outcomes and descriptors for a qualification
Source []

Transversal competences are those capacities that transcend a certain field or study programme, having a transdisciplinary nature: teamwork skills, oral and written communication in mother tongue / foreign language, use of ICT, problem solving and decision making, recognition of and respect for diversity and multiculturality, learning autonomy, initiative and entrepreneurship, openness to lifelong learning, respecting and improving professional values and ethics etc.

8.3.3 Types and Descriptors of Competences

Professional competences are the integrated and dynamic unit of knowledge, skills and autonomy and responsibility (Fig.8.3):

Knowledge, as cognitive dimension and structural element of the competence, is expressed in terms of the following descriptors:

(1) Knowledge, understanding and use of specific language;

(2) Explanation and interpretation;

Skills, as functional-actional dimension and structural element of the competence, are expressed in terms of the following descriptors**:**

(3) Application, transfer and problem solving;

(4) Critical and constructive reflection;

(5) Creativity and innovation;

(6) Communication.

Autonomy and responsibility, as attitude dimension and structural element of the competence, are expressed in terms of the following descriptors (Fig.8.3)**:**

(7) Supervision and assistance in relation with the task nature and complexity;

(8) Responsibility.

Transversal competences transcend a certain study programme/field. They refer to **Social and personal development** and are expressed in terms of the following descriptors:

(9) Social interaction;

(10) Life and career management.

8.3.4 Conceptual-Methodological Model for Describing Qualifications in the Air Transport Sector: SQFAT Matrix and Grid 1

The conceptual-methodological model is a reference framework developed for the analysis, description and interpretation of qualifications in the Air Transport Sector.

The SQFAT model is compatible with the European Qualifications Framework (EQF) vision [26], especially with the learning outcomes specified by the EQF for qualification levels 5, 6, 7 and 8.

The structure and contents of the model capitalize on descriptors of the overarching framework for qualifications for the European Higher Education Area as well as on contents elements of models that already enjoy the appreciation of European experts (the French, Irish, British models etc).

At the same time, this model has its own identity; it integrates categories and types of competences, qualification levels and specific descriptors while following consistently the conceptual basis presented at paragraph 8.3.3.

The essential elements of this model are the SQFAT Matrix (Fig.8.4) and a qualification descriptive instrument, Grid 1, particularise for each four levels of qualifications taken into consideration: level 5 (Fig.8.6), Bachelor (Fig. 8.7), Master (Fig.8.8), and Doctorate (Fig. 8.9).

a) Sectorial Qualifications Framework for Air Transport Matrix (Fig.8.4)

The Tertiary education qualifications matrix includes: qualification levels, learning outcomes expressed in terms of knowledge, skills and autonomy and responsibility as well as the level descriptors for qualifications in tertiary education.

The level descriptors for each type of learning outcomes detail the generic descriptors for each type of competence and for each qualification level: level 5, Bachelor, Master, and Doctorate.

From a structural point of view, the SQFAT matrix integrates professional and transversal competences, each of the two categories of competences having its legitimacy and importance in practising a profession. They form a solidary couple that expresses the professional efficiency and effectiveness of a study programme graduate.

Professional competences are expressed in terms of knowledge, skills and autonomy and responsibility which cover comprehensively the professional expertise for any qualification.

In the matrix the **transversal competences** refer to **social and personal development.** These take into account the social and group context of practising a profession, as well as the awareness of the continuing training need.

The generic descriptors introduced in the matrix indicate expected activities, outcomes and performance for each qualification level. They allow for the ***description*** of qualifications and, at the same time, formulate the necessary landmarks for the ***assessment*** of the competence level.

The matrix is an integrative approach of tertiary education qualifications and it provides two perspectives for the analysis of these qualifications: vertical and horizontal.

a) The vertical analysis indicates the progress in professional competences from the level of *knowledge and understanding* (generic descriptor 1), the basic level of a learning outcome, to the responsibility (generic descriptor 8), as well as the transversal competences (generic descriptors 9 and 10). Thus, professional competences are analysed and described in light of the generic descriptors 1 - 8 and the transversal competences are analysed and described in light of the generic descriptors 9 and 10.

The vertical perspective emphasizes that a certain level of competence can be reached only if the subordinated levels have been achieved and consolidated.

b) The horizontal analysis presents a generic descriptor against the four tertiary education cycles: level 5, Bachelor, Master and Doctorate. In this case, the descriptors highlight the competence development and the increase in the professional qualification level. One can notice that the model targets another type of progress, suggesting an increase in the *added value* for each type of learning outcome with the progress from one university qualification level to another.

			LEVEL 5	BACHELOR	MASTER'S	DOCTORATE
Transversal competences	Social and personal development	10. Life and career management	Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.	Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Development of creativity-centred projects as the basis for self-accomplishment
		9. Social interaction	Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.	Interaction within professional groups or institutions	Capacity to organise and lead the activities of professional groups, research groups or institutions.
Professional competences	Autonomy and responsibility	8. Responsibility	Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study	Take responsibility for decision-making in predictable, unpredictable work or study context	Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Assuming responsibility and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts, including research.
		7. Supervision and assistance in relation with the nature and task complexity	Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures	Supervision and assistance in managing complex technical or professional activities or projects	Undertaking complex and unpredictible professional tasks under autonomy and professional independence conditions.	Demonstrate substantial authority, autonomy scholarly and professional integrity in complex and unpredictibile research, education and professional context.
	Skills (functional-actional dimension)	6. Communication	Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public
		5. Creativity and innovation	Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	Development of professional and/or research projects using well known principles, methods and software within the field	Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Design and undertake original research, based on advanced methods leading to the development of scientific and technological knowledge and/or of the research methodologies
		4. Critical and constructive reflection	Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	Critical/constructive assessment of projects and scientific research results, appraisal of the stage of theoretical and methodological knowledge; identification of knowledge and applicative priorities within the field
		3. Application, transfer and problem solving	Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	Application of advanced principles and methods to solve complex and unpredictable problems/situations that are typical to the field of work /study.	Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Select and use advanced principles, theories and methods of knowledge, transfer of methods from one field to another, interdisciplinary approaches to solve new and complex theoretical and practical problems
	Knowledge (cognitive dimension)	2. Explanation and interpretation	Use adequate documentation, catalogs and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Use advanced principles and methods to explain and interpret, from multiple perspectives, new and complex theoretical and practical problems that are specific to the respective field
		1. Knowledge, understanding and use of specific language	Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area;	In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Systematic, advanced knowledge of concepts, research methods, controversies, new hypothesis specific to the field; communication with specialists from related fields
Learning outcomes		Generic descriptors	Level descriptors			

Figure 8.4 Sectorial qualifications framework for air transport matrix (Tertiary education qualifications matrix)

The horizontal perspective demonstrates that each level of competence related to the three study cycles bachelor, master and doctorate can integrate the previous levels, an exception could be level 5 which not necessary is integrated in the higher levels. As a result, each level of a given competence has a relative autonomy, being conditioned by prior attainments, both horizontally and vertically.

b) Grid 1: Description of the study field/programme by means of professional and transversal competences

Grid 1 (Fig. 8.6; Fig. 8.7; Fig. 8.8 and Fig. 8.9), underpinned by the SQFAT Matrix, is a tool for the analysis, description and evaluation of a qualification obtained through a postsecondary, Bachelor, Master's or Doctorate programme. It includes: the name of the study programme, the qualification title and level, the level descriptors of professional and transversal competences (Fig. 8.3), as well as the minimum performance standards.

Grid 1 is the support for identifying the correspondence between **occupations** and respective qualification and the main **professional and transversal competences.** The professional and transversal competences are, in fact, basic competences, mandatory for a qualification, and individualized with respect to each level descriptor. Each high and higher education institution may add elements that are specific to their curricular provision, filling in according to the standard template for Grid 1 a similar form where they shall indicate a maximum of four competences, others than the common ones described in Grid 1.

Assessment of competence presupposes the description of the minimum performance standards.

The assessment of transversal competences is mainly a **qualitative** one and it generally **involves** a **holistic approach** of the various social and group contexts for practising a profession as well as for the personal and professional development.

8.4 Description of Qualifications for Air Transport Sectors' Levels 5, 6, 7 and 8

Grid 1 "Description of study programme by identifying the professional and transversal competences" (Fig. 6) is filled in for each qualification level, by study programme, as follows.

For filling in Grid 1, the following stages should be accomplished (Fig. 8.5):

1. **Determine** the name of the study field, study programme and the qualification level (Level 5, Bachelor, Master, Doctorate);
2. **Identify** possible occupations which could be practised with the qualification.

The qualification definition sources can be: Classification of Occupations in the KAAT - Project parceners country, documents concerning qualifications, elaborated by EC or international bodies of aviation: EQF, EASA documents, ICAO recommendations, ESCO, CEDEFOP analysis, various professional roles, professional standards (if any), occupational standards, marketing surveys, forecasted developments on the labour market etc.

Generally, this analysis will lead to two results:

i. A list of possible occupations;
ii. Identification of core/basic competences necessary for practising the respective occupations.

3. Select possible occupations for the graduates of the respective study programme, insert them in the grid.

4. Define minimum common competences that, for a given period of time, ensure successful practice of the respective occupations. The minimum common competences are considered compulsory core competences for a qualification (C1, C2...).

5. Detail each professional competence according to the 5 level descriptors (1-10), as concisely as possible.

6. Mention the transversal competences trained and/or developed within the study programme (qualification) using the level descriptors.

7. Determine the minimum performance standards.

The minimum standards will refer to two plans: the descriptors plan, indicating the minimum level of development of knowledge and skills envisaged from the point of view of each descriptor; and the achieved outcome, namely the effects or consequences of applying/ demonstrating the respective competence as a whole.

The table will mention the minimum performance standards for the entire competence.

In case of already existing qualifications in the post-secondary and higher education institutions provision Grids 1- level 5, Grid -1 Bachelor, Grid 1 Master's, and Grid- 1 Doctorate will be filled in by a working group (made of 2-4 people), set up by KAAT experts through consultation with education institutions and sectoral committees.

At the project level, the grids will be validated by the Steering Committee based on partners' proposals and after consultation with employers, professional associations, trade unions, employers' associations, stakeholders from air transport sectors.

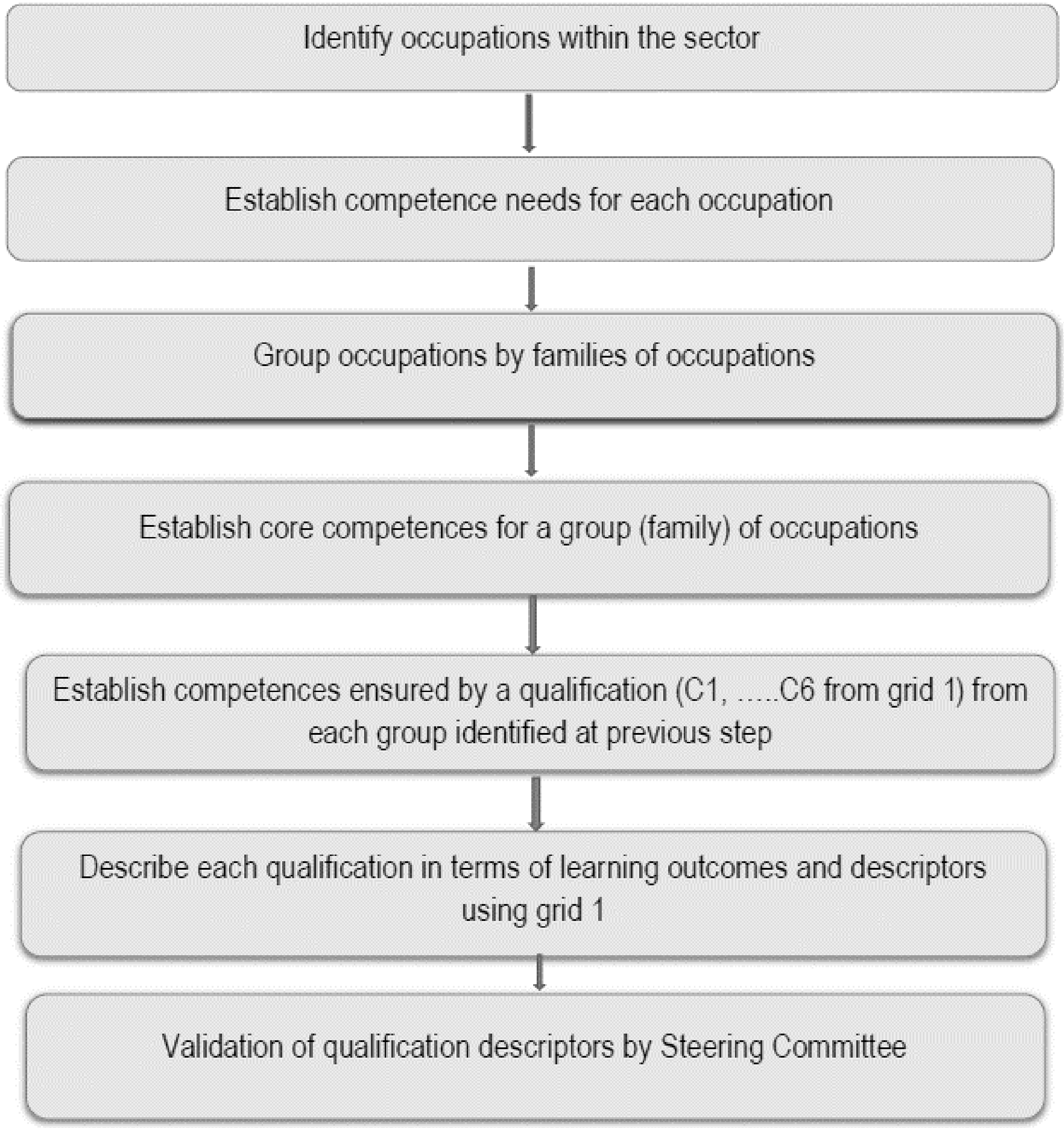

Figure 8.5 Steps in qualification description by learning outcomes and descriptors

In case of newly proposed qualifications, Grid 1 will be filled in by the training provider who proposes the qualification. After stage 1 has been finalised, the qualification description could be registered in the SQ Register.

Study Field ……………………………… **Study Programme/ Training programme** ……………………………………..

Grid 1 – *Description of study programme/training by means of learning outcomes and descriptors*

Qualification Title ………………….. **Qualification Level: 5**	Existing and possible occupations					
DESCRIPTORS / **COMPETENCES**	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
KNOWLEDGE						
1. Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	C1.1	C2.1	C3.1	C4.1	C5.1	C6.1
2. Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C1.2	C2.2	C3.2	C4.1	C5.2	C6.2
SKILLS						
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C1.3	C2.3	C3.3	C4.3	C5.3	C6.3
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C1.4	C2.4	C3.4	C4.4	C5.4	C6.4
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	C1.5	C2.5	C3.5	C4.5	C5.5	C6.5
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C1.6					
AUTONOMY AND RESPONSIBILITY						
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures						
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study						
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work						
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management.						
Minimum performance standards for competence assessment:	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**

Figure 8.6 Grid for SQFAT – Level 5

Study Field .... **Study Programme/ Training programme** ....

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title.................................... Qualification Level: **6 - BACHELOR**	Existing and possible occupations					
COMPETENCES / **DESCRIPTORS**	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
KNOWLEDGE						
1. Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area	C1.1	C2.1	C3.1	C4.1	C5.1	C6.1
2 Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	C1.2	C2.2	C3.2	C4.1	C5.2	C6.2
SKILLS						
3. Application of advanced principles and methods to solve complex and unpredictable problems/situations that are typical to the field of work /study.	C1.3	C2.3	C3.3	C4.3	C5.3	C6.3
4 Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	C1.4	C2.4	C3.4	C4.4	C5.4	C6.4
5. Development of professional and/or research projects using well known principles, methods and software within the field	C1.5	C2.5	C3.5	C4.5	C5.5	C6.5
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C1.6					
AUTONOMY AND RESPONSIBILITY						
7. Supervision and assistance in managing complex technical or professional activities or projects						
8. Take responsibility for decision-making in predictable, unpredictable work or study context						
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.						
10. Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.						
Minimum performance standards for integrated learning outcomes assessment:	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**

Figure 8.7 Grid for SQFAT - Level 6 Bachelor

Study Field ……………………………… **Study Programme/ Training programme ……………………………………….**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title ……………………………………… **Qualification Level: 7 - MASTER**	Existing and possible occupations					
DESCRIPTORS / **COMPETENCES**	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	C1.1	C2.1	C3.1	C4.1	C5.1	C6.1
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	C1.2					
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	C1.3					
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	C1.4					
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	C1.5					
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C1.6					
AUTONOMY AND RESPONSIBILITY						
7. Undertaking complex and unpredictable professional tasks under autonomy and professional independence conditions.						
8. Assuming responsibility to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.						
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions						
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams						
Minimum performance standards for integrated learning outcomes assessment:	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**

Figure 8.8 Grid for SQFAT - Level 7 Master

Study Field ………………………………   Study Programme/ Training programme ………………………………………

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title ……………………………………… Qualification Level: 8 - DOCTORATE	Existing and possible occupations					
DESCRIPTORS / **COMPETENCES**	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
KNOWLEDGE						
1. Systematic, advanced knowledge of concepts, research methods, controversies, new hypothesis specific to the field; communication with specialists from related fields	C1.1	C2.1	C3.1	C4.1	C5.1	C6.1
2 Use advanced principles and methods to explain and interpret, from multiple perspectives, new and complex theoretical and practical problems that are specific to the respective field	C1.2					
SKILLS						
3. Select and use advanced principles, theories and methods of knowledge, transfer of methods from one field to another, interdisciplinary approaches to solve new and complex theoretical and practical problems	C1.3					
4. Critical/constructive assessment of projects and scientific research results, appraisal of the stage of theoretical and methodological knowledge; identification of knowledge and applicative priorities within the field	C1.4					
5. Design and undertake original research, based on advanced methods leading to the development of scientific and technological knowledge and/or of the research methodologies	C1.5					
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C1.6					
AUTONOMY AND RESPONSIBILITY						
7. Demonstrate substantial authority, autonomy scholarly and professional integrity in complex and unpredictable research, education and professional context.						
8. Assuming responsibility and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts, including research.						
SOCIAL AND PERSONAL DEVELOPMENT						
9. Capacity to organise and lead the activities of professional groups, research groups or institutions.						
10. Development of creativity-centred projects as the basis for self-accomplishment						
Minimum performance standards for integrated learning outcomes assessment:	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**

Figure 8.9 Grid for SQFAT - level 8 Doctorat

9 Qualification Grids for the Air Transport Qualifications

INTRO

9.1 Description of Qualification Level 4

9.1.1 Description of Qualification for Pilot Private Licence (PPL)

Study Field ………………………………… **Training programme Pilot Private Licence (PPL)**

Grid 1 – *Description of study programme/training by means of learning outcomes*

Qualification Title: Pilot Private Licence (PPL) **Qualification Level: 4**	**Existing and possible occupations:** "Private pilot" means a pilot who holds a licence which prohibits the piloting of aircraft in operations for which remuneration is given, with the exclusion of instruction or examination activities.				
COMPETENCES **DESCRIPTORS**	**C1** **Implementation of aviation legislation for carrying out activities in specific operational processes.**	**C2** **Using basic knowledge of human performance and limitations in promoting safety and efficiency in flight operations.**	**C3** **Interpret the physical properties of the atmosphere and the factors affecting aviation operations.**	**C4** **Integrated use of the standard communication procedures and phraseology to ensure efficient communication in air traffic services.**	**C5** **State and describe basic aerodynamics principles for making carrying out duties more effectively.**
KNOWLEDGE					
1. Use of the concepts, principles, processes and standards / regulations particular to a very specialized field of work or study.	C1.1 Description of basic aviation legislation (international, European, and national legislation), rules of the air and an appropriate air traffic services practices and procedures;	C2.2 Define the principles and methods of the basic aviation physiology and health maintenance, human error and human behaviour in critical situation;	C3.1 Description of weather theory, recognition of the different weather phenomena and state the effect of hazardous weather conditions;	C4.1 Describe VFR communications principles, transmission of letters, transmission of numbers (including level info), transmission of time and general transmission technique;	C5.1 Identify the physical laws of aerodynamics, to include Newton's laws of motion and the Bernoulli principle; Making simple calculations in a shortest time, i.e. to convert knots [kt] into metres/second [m/s], and know the appropriate conversion factors by heart;
2. Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C1.2 Use of basic knowledge to interpret visual flight rules, signals and interception of civil aircraft; Identify rules and regulations relevant to the holder of a private pilot license;	C2.2 Using basic knowledge in human factors to identify problem areas for pilots, principles of communication: verbal and non-verbal communication;	C3.2 Use basic knowledge to interpret pre-flight weather planning (METAR, TAF) and state methods to interpret weather briefing documents;	C4.1 Use standard words and phrases, communication principles and essential speaking skill in communication with air traffic control before take-off, during flight and landing;	C5.2 Use basic knowledge to interpret operating limitations;
SKILLS					
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C1.3 Interpret the information from AIP, NOTAM, general airport standards and regulations for flight plan development and for safety	C2.3 Applying basic aviation physiology standards and health maintenance for correlation between the human being, his aircraft and the flying environment;	C3.3 Application of elementary aeronautical meteorology principles, standard procedures to create a flight plan, which details	C4.3 Apply standard communications procedures and phraseology, air traffic services procedures and methods for efficient communication in air traffic	C5.3 Applying basic principles and methods for pre-flight preparations, mass and balance determination, aircraft inspection, etc;

	aerodrome and traffic pattern operations;		the altitude for the flight, route to be taken and amount of fuel required;	services, for operations to, from and transiting controls aerodromes;	
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C1.4 Notify and apply procedures related to precautionary and emergency procedures, including action to be taken to avoid hazardous weather, wake turbulence and other operating hazards;	C2.4 Criticize avoiding and managing errors: cockpit management procedure.	C3.4 Notify the effect of adverse weather conditions;	C4.4 Follow standard communication procedures in case of failure;	C5.4 Notification about forced landing without power, provision for change of plan;
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	C1.5 Operational reporting system provides possibility to report hazards or any safety concerns;	C2.5 Monitor and report duty and rest period;	C3.5 Define and identify phenomena that have negative effect on a flight;	C4.5 Create a flight using standard radiotelephony phraseology;	C5.5 Perform mass and balance calculation;
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C1.6 Understanding and use of proper standard words and phrases (relevant RTF phraseology included), ATS abbreviations, Q-code groups commonly used in RTF air - ground communications, RTF call signs for aeronautical stations including use of abbreviated call signs;	C2.6 Efficient communication with other crew, if applicable;	C3.6 Interpreting METARs and TAFs information;	C4.6 Use of proper standard words and phrases (relevant RTF phraseology included) for efficient communication with Air Traffic Controllers;	C5.6 Communication with handling department for information for mass and balance calculation;
AUTONOMY AND RESPONSIBILITY					
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures	Holder of a PPL(A) shall demonstrate the ability to perform, as PIC (pilot in command) on aeroplanes, the relevant procedures and manoeuvres with competency appropriate to the privileges granted. Should demonstrate the ability to: operate the aeroplane within its limitations; complete all manoeuvres with smoothness and accuracy; exercise good judgment and airmanship; apply aeronautical knowledge; maintain control of the aeroplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.				
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study	Responsible execution of pre-flight inspection, flight in safety conditions (take-off and landing), choose routes, altitudes, and speeds that will provide the fastest, safest, and smoothest flights based on documentation such as load weights, fuel supplies, weather conditions, in order to determine flight plan, and to see if changes might be necessary;				
SOCIAL AND PERSONAL DEVELOPMENT					
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	Develop the ability to make an independent operating decisions;				

10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	Recognizing and improve weak points by recurrent training and increases confidence on skills in taking flight;
Minimum performance standards for competence assessment:	A pass in a theoretical knowledge examination paper will be awarded to an applicant achieving at least 75 % of the marks allocated to that paper. Related to flight training candidate need to demonstrate complete knowledge of required topics, procedures, etc., to achieve the good standards the overall level of performance is well above requirements but minor knowledge "gaps" are acceptable;

COMPETENCES / DESCRIPTORS	**C6** **Relate and implement standard operational procedure which need to be done before flight, in-flight and after flight to comply with safety practices.**	**C7** **Establish, organize and control flight performance of the aircraft and adapt flight planning to existing condition.**	**C8** **Identify and describe essential components of an aircraft and define systems needed to fly an aircraft efficiently and safely, whilst exercising proper maintenance of the airframe.**	**C9** **Explain and trace the basic principles of general navigation and radio navigation which includes the process of planning, recording, and controlling the movement of a aircraft from one place to another.**
KNOWLEDGE				
1. Use of the concepts, principles, processes and standards / regulations particular to a very specialized field of work or study.	C6.1 Appropriate identification of basic principles in general operational requirements, applicable rules, altimeter setting procedures;	C7.1 Description of effects of loading and mass distribution on flight characteristics, pre-flight and en-route flight planning appropriate to private operations under VFR, preparation and filing of air traffic services flight plans;	C8.1 Enumerate the basics of an aircraft's electrical, mechanical and hydraulic systems, engine, describe how the mechanical and electrical parts work;	C9.1 Description of basic concepts, theories, methods and principles of practical aspects of air navigation and dead-reckoning techniques;
2. Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C6.2 Use knowledge to carry out pre-flight checks on the navigation and operating systems, and act as a Student Pilot in Command (PIC);	C7.2 Use basic knowledge to perform the take-off run and distance available (TORA, TODA) calculation, maximum load and maximum mass calculation, calculation of a short range or long-range flight plan;	C8.2 Using basic knowledge to interpret information from POH (Pilot Operational Handbook) and familiarized with the airplane characteristics (cockpit layout, systems, checklists, drills and controls);	C9.2 Use knowledge for charts reading and establish location in relation to the environment or to know where other objects are in relation to you;
SKILLS				
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C6.3 Apply airport safety procedures for preparation for and action after flight (flight authorization and airplane acceptance, serviceability documents, equipment required, maps etc), external and internal checks;	C7.3 Applying flight performance standards to perform routine flight operations checks, perform take-off and landing, cross-country flying using visual reference, dead reckoning and radio navigation aids;	C8.3 Applying basic knowledge of the POH to operate cockpit control panels, operate radar equipment, operate radio equipment, operate radio navigation instruments, operate two-way radio systems, etc;	C9.3 Application of general and radio navigation procedures route choice, to perform calculations of magnetic heading, time en-route, fuel consumption, mass and performance, etc;
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C6.4 Notification in case of flight at critically low airspeeds, recognition of, and recovery from, incipient and full stalls;	C7.4 Notification in case of normal and crosswind take-offs and landings or short-field landings;	C8.4 Apply the action required in case of fire on the ground and in the air, engine	C9.4 Notification in case of the overflight in a danger, prohibited and restricted

			cabin and electrical system fire; systems failure;	area or navigation problems at lower levels and reduced visibility;
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	C6.5 Apply emergency and precautionary landings, airport safety procedures;	C7.5 Perform operations in areas of high-density traffic and use practical application of take-off, landing and other performance data;	C8.5 Solving technical problems during flight and reporting inappropriate work of the aircraft systems;	C9.5
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C6.6 Understanding and use of standard terminology in English language at required level in relation with air traffic controllers;		C8.6 Use technical terms in communication with aircraft engineer;	C9.6 Optimal solution for issues relating to route changing, fuel consumption, mass and balance calculation;
AUTONOMY AND RESPONSIBILITY				
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures	Holder of a PPL(A) shall demonstrate the ability to perform, as PIC (pilot in command) on aeroplanes, the relevant procedures and manoeuvres with competency appropriate to the privileges granted. Should demonstrate the ability to: operate the aeroplane within its limitations; complete all manoeuvres with smoothness and accuracy; exercise good judgment and airmanship; apply aeronautical knowledge; maintain control of the aeroplane at all times in such a manner that the successful outcome of a procedure or manoeuvre is never seriously in doubt.			
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study	Responsible execution of pre-flight inspection, flight in safety conditions (take-off and landing), choose routes, altitudes, and speeds that will provide the fastest, safest, and smoothest flights based on documentation such as load weights, fuel supplies, weather conditions, in order to determine flight plan, and to see if changes might be necessary;			
SOCIAL AND PERSONAL DEVELOPMENT				
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	Develop the ability to make an independent operating decisions;			
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	Recognizing and improve weak points by recurrent training and increases confidence on skills in taking flight;			
Minimum performance standards for competence assessment:	A pass in a theoretical knowledge examination paper will be awarded to an applicant achieving at least 75 % of the marks allocated to that paper. Related to flight training candidate need to demonstrate complete knowledge of required topics, procedures, etc., to achieve the good standards the overall level of performance is well above requirements but minor knowledge "gaps" are acceptable;			

9.2 Description of Qualification Level 5

9.2.1 General Presentation of Pathways for Pilots

Where today's airline pilots come from

Every year CAE works with more than 300 airlines and trains more than 120,000 pilots, connections that give them unique insights into both market and industry needs. After analysing the requirements and projected growth in passenger air traffic, CAE revealed their insight to the broader industry through the Airline Pilot Demand Outlook publication they released in June 2017 [10].

Pilot/ Aircraft Ratios

The number of pilots required per aircraft is primarily determined by aircraft utilization and related regulations. All commercial aircraft require at least one licensed captain and a second pilot, who is either a captain or first officer, in the cockpit. To maximize aircraft utilization, airlines need to adequately crew their aircraft. Most of today's airlines fly fleets of regional aircraft, narrow-body jets and wide-body jets to serve a variety of short-, medium- and long-range routes with aircraft size and seat capacity optimized to match passenger demand.

Over the last 10 years, the increase in aircraft utilization resulting from efficiency improvements has driven a slight growth in the average crew ratio and is expected to remain at a similar level over the next decade.

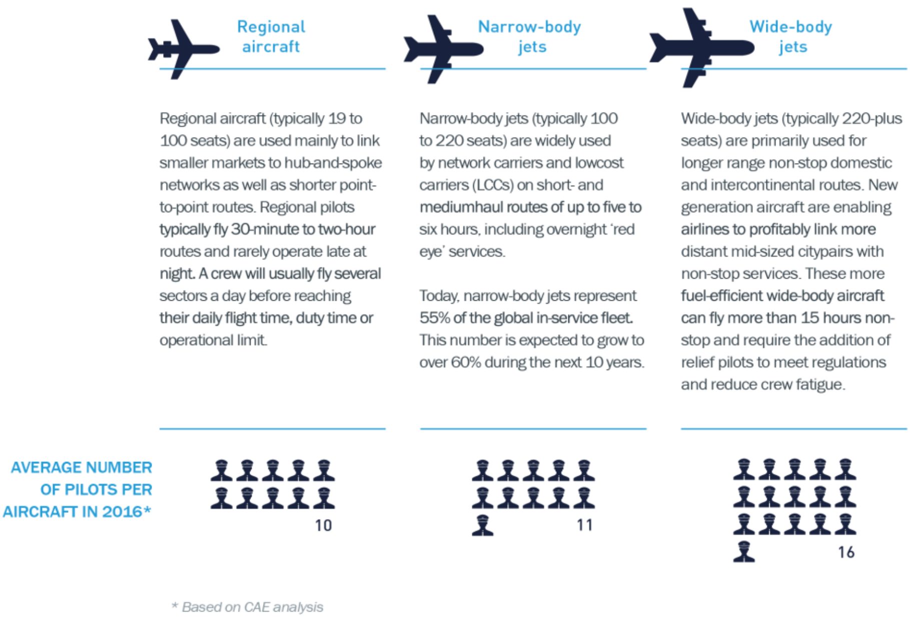

Figure 9.1 Average number of pilots per aircraft
Source: [10]

Pilot Retirement and Attrition

Most national regulators impose a mandatory retirement age of 65 for airline pilots. Other reasons for leaving the workforce include early retirement, the pursuit of a non-flying career, loss of medical fitness, etc.

The Americas have the highest average pilot age. North America's high percentage of senior pilots reflects significant recruitment activity in the 1980s and 1990s as airline deregulation expanded the industry and major hubs were developed. The recent consolidation of network carriers and their focus on efficiency slowed new hiring. Europe has seen an influx of younger professional pilots over the past 15 years which can be partially attributed to the rapid expansion of LCCs. In addition, many experienced European pilots have moved to the more rapidly growing Middle East and Asia-Pacific regions. This has left Europe with the youngest average pilot group of any region.

As experienced captains retire, a chain reaction of pilot upgrades and new hires is triggered. For example, the departure of an experienced wide-body captain creates the need to upgrade a first officer to fill the vacant seat. This then creates downward pressure on airlines to develop and upgrade more first officers and captains.

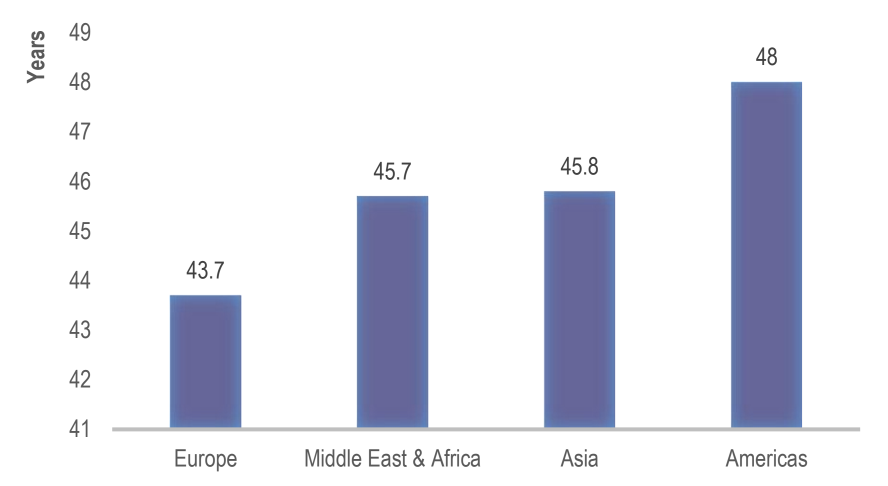

***Figure 9.2** Average pilot age in 2016*
(source: https://www.cae.com/media/documents/Civil_Aviation/CAE-Airline-Pilot-Demand-Outlook-Spread.pdf)

Filling Tomorrow's Cockpits

Airlines are not just looking for first officers to fill the right seat. They're looking for candidates with the potential to become captains within their organizations. As an industry, we must continuously improve and adapt our assessment and selection processes for different regions and airlines to reflect pilot competency requirements.

Careful matching of individual aptitude with airline needs will allow airlines to identify candidates today who can evolve into their future captains. A thorough screening and selection process performed early in the training process has proven to be very successful in identifying candidates with the right mix of language proficiency, flying skills and attitude to evolve into high-quality pilots.

In addition to identifying future potential captains, airline requirements can be used to assess if the candidate, whether an aspiring cadet or a direct entry pilot, will be able to flourish within the airline's culture. For example, one airline might need a pilot willing to travel for extended periods prior to returning home, while another airline might only offer daily short-haul return flights. An in-depth mapping of airline needs along with a multifaceted assessment of each candidate can correctly match the right candidate with the right airline.

Airlines are also developing programmes to tap into an underrepresented labour pool – female pilots. These programmes encourage young women to consider an aviation career and provide airline sponsorship for flight training. Women currently represent less than 5% of airline pilots.

As the assessment and selection process improves, we're seeing lower dropout rates and higher placement rates. Ensuring the right fit is allowing candidates to flourish while increasing retention rates.

In 2016, approximately 20,000 pilots entered the airline profession around the world from three main sources:

AIRLINE - FOCUSED FLIGHT TRANING ACADEMIES	Some 6,500 pilots hired in 2016 were trained at professional academies that work directly with airlines to identify and meet their requirements needs. These academies focus on creating professional pilots and, in general, over 90% of their graduates become airline pilots.
UNIVERSITIES, MILITARY & BUSINESS AVIATION	Approximately 3000 pilots came from military, business jet or university backgrounds. Some universities offer undergraduate programs in combination with commercial pilot training. However, a small portion of these individuals pursue a career as airline pilots.
SMALL REGIONAL FLIGHT CLUBS & SCHOOLS	Some 10500 pilots came from smaller independent training organizations generally located at smaller airports and serving both recreational and commercial pilots. Less than 70% of these trainees become airline pilots

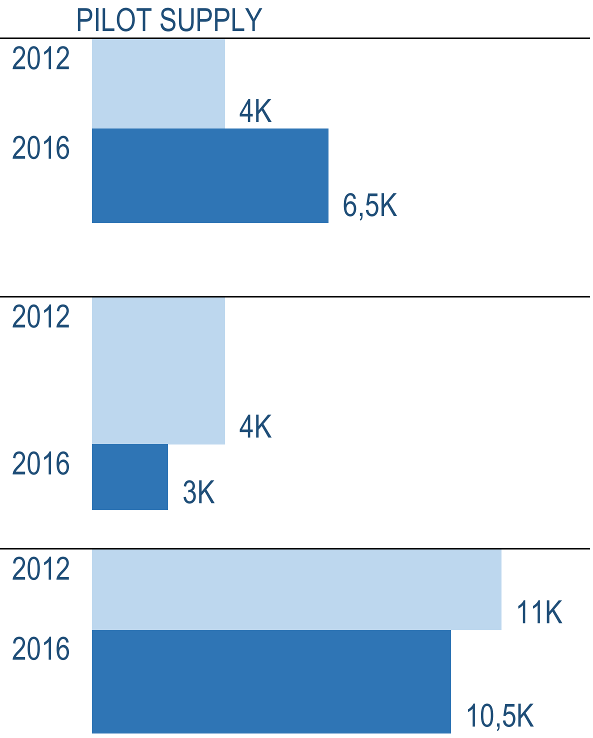

Figure 9.3 Pilot supply

(source: https://www.cae.com/media/documents/Civil_Aviation/CAE-Airline-Pilot-Demand-Outlook-Spread.pdf)

Developing tomorrow's airline pilots

While onboarding 255,000 new first officers, the industry also needs to transition 180,000 pilots into captains by 2027. The aviation industry continues to raise the bar for pilot training and increase its expectations of pilots. At the same time, we're seeing much faster promotions to captain.

A few years ago, it was common to see a co-pilot spend eight to ten years working in the right seat before becoming captain. Today, first officers are given the opportunity to upgrade with much less seniority than in the past. In fact, it's not uncommon to see a pilot taking full command of an aircraft after only a few years as a co-pilot.

This steeper pilot learning curve places additional stress on the current training system. It's becoming a challenge to train to the new standards in the time allocated. As a result, the need for remedial training is increasing. Although remedial training is a valid mitigation tactic, it impacts operations as pilots are removed from line flying to undergo addition training. To adapt to today's realities and ensure pilot readiness, we must improve training effectiveness.

Emerging training and technology innovations that integrate training data with line performance data can help build such an approach.

Adaptive training delivery

By providing an instructor with data-driven training insights, the instructor can adapt the training session to be more effective. This yields tools the instructor can leverage to objectively assess pilot performance. Through a better understanding of the pilot's profile, the instructor is able to adapt training and delivery to better address the competency gaps. A word of caution: not all senior pilots are effective instructors. We must look for instructors with the right mix of teaching and communication skills to ensure we provide the most effective training.

In 2016, approximately 20,000 pilots entered the airline profession around the world from three main sources.

Airline-focused flight training academies Some 6,500 pilots hired in 2016 were trained at professional academies that work directly with airlines to identify and meet their recruitment needs. These academies focus on creating professional pilots and, in general, over 90% of their graduates become airline pilots.

Universities, military & business aviation Approximately 3,000 pilots came from military, business jet or university backgrounds. Some universities offer undergraduate programs in combination with commercial pilot training. However, a small portion of these individuals pursues a career as airline pilots.

Small regional flight clubs & schools Some 10,500 pilots came from smaller independent training organizations generally located at smaller airports and serving both recreational and commercial pilots. Less than 70% of these trainees become airline pilots.

Airline-focused flight training academies produce an increasing proportion of the pilots flying in today's commercial airlines. These professional academies provide an environment with set schedules, access to pilots, mentoring, mandatory uniforms and an airline mindset. When enrolled in programs built to airline-specific operating procedures, cadets train to a professional standard from day one.

Today, almost 10% of airline pilots in Asia Pacific are expatriates. (Based on CAE analysis)

Airlines in regions of rapid growth face limited access to experienced pilots in their markets. To address this challenge, they focus on accelerating the development of junior first officers, a lengthy process, and on hiring experienced first officers and captains from more mature markets.

Almost 10% of airline pilots today in Asia Pacific are expatriates. In some instances, airlines in the Middle East source over half of their pilots from outside their region.

Compensation is a key tool used by airlines to attract experienced pilots. Middle Eastern and Asia-Pacific carriers offer, on average, a 10% to 15% salary premium to their pilots compared to carriers in the western hemisphere. Airlines in China sometimes offer salary premiums in excess of 70%. Combined with advantages such a tax relief, many fast growing markets continue to attract experienced pilots.

Pilot training progression

The continuous evolution of pilot training regulations has contributed to the air transport industry's safety record. Over the past few decades, the industry has consistently improved pilot training to further enhance safety.

Former regulatory requirements emphasized highly structured and rigid training programs to ensure global compliance and standardization. However, over the past two decades, regulated training has increasingly leveraged the use of data and competencies to improve training outcomes.

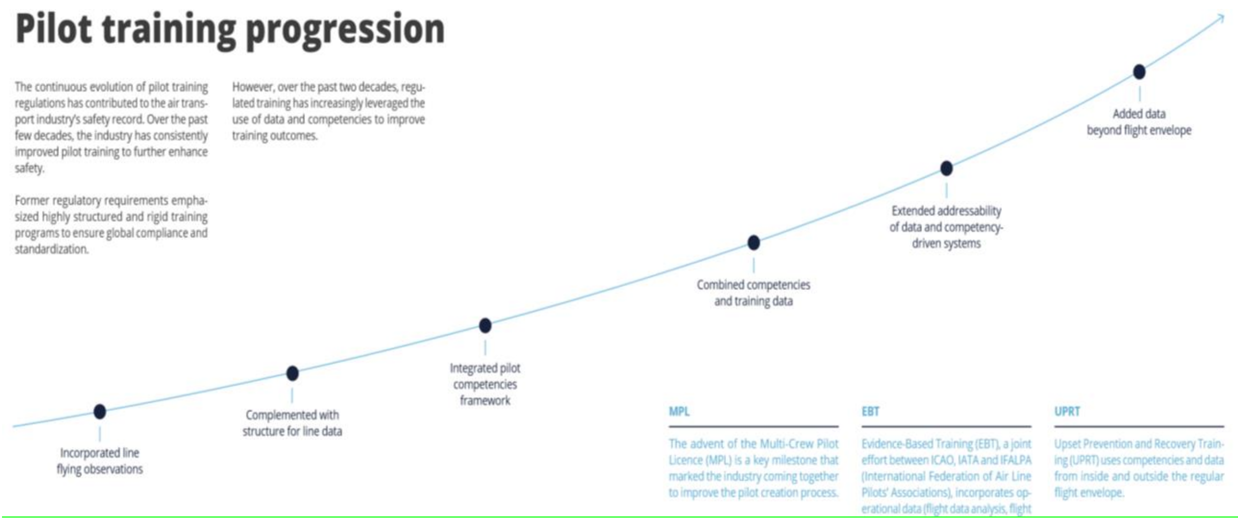

Figure 9.4. Pilot training progression
(source: https://www.cae.com/media/documents/Civil_Aviation/CAE-Airline-Pilot-Demand-Outlook-Spread.pdf)

AQP/ATQP

The FAA introduced the Advanced Qualification Program (AQP) as an alternate means for complying with existing rigid regulated training. The European equivalent, the Alternative Training and Qualification Program (ATQP), was introduced later under EASA.

AQP and ATQP allowed the industry to leverage line-flying experience to inform and improve training.

Airlines were now able to modify their training programs to address their unique operational requirements.

Today, over 80% of airline pilots in the US are training under an AQP.

FOQA

Supported by ICAO, Flight Operations Quality Assurance (FOQA), also known as Flight Data Monitoring (FDM), brought in a structured approach to collecting line flying data.

Recurrent AQP/ATQP programs benefited from FOQA by leveraging line-data analysis to improve training outcomes.

The majority of airlines training under AQP programs today have FOQA and data analysis capabilities.

ICAO pilot competencies

The International Civil Aviation Organization (ICAO) developed a framework of eight competencies covering the knowledge, skills and attitude required to fly in a commercial environment.

This elevated the importance of leadership, communication, situational awareness and decision making by providing a framework to develop and assess pilots.

MPL

The advent of the Multi-Crew Pilot Licence (MPL) is a key milestone that marked the industry coming together to improve the pilot creation process.

MPL leveraged ICAO's competency framework and introduced an objective development process for cadets.

MPL further leverages the increased use of simulation based training by having cadets spend over half of their practical training in a commercial aircraft cockpit as opposed to a small private aircraft.

These ab-initio programs provide an effective way to train high-quality pilots in a line-flying environment. The first MPL graduates are now successful captains.

EBT

Evidence-Based Training (EBT), a joint effort between ICAO, IATA and IFALPA (International Federation of Air Line Pilots' Associations), incorporates operational data (flight data analysis, flight observations and air safety reports) into pilot training and assessment to improve air safety.

This helps develop and assess the overall capability for training across the range of competencies.

EBT provides a baseline, ready-made training program that allows smaller operators to adopt data-driven, competency-based training.

UPRT

Upset Prevention and Recovery Training (UPRT) uses competencies and data from inside and outside the regular flight envelope.

It addresses the number one cause of accidents leading to fatalities by focusing on the competencies related to situational awareness and manual flying.

UPRT training is now required by EASA and will be required by the FAA for all FAR 121 operators by 2019, alongside full stall and adverse conditions training (bounced landing, icing and crosswinds on take-off).

Conclusion

Regulated training increasingly leverages the use of data and competencies to improve training outcomes.[4]

[4] https://www.cae.com/media/documents/Civil_Aviation/CAE-Airline-Pilot-Demand-Outlook-Spread.pdf

9.2.2 Description of Qualification Commercial Pilot Licence (CPL)

Study Field ……………………………… **Training programme Commercial Pilot Licence (CPL)**

Grid 1 – *Description of study programme/training by means of learning outcoms*

Qualification Title: Commercial Pilot Licence (CPL) Qualification Level: 5	Existing and possible occupations				
COMPETENCES / DESCRIPTORS	C1 Implementation of aviation legislation for carrying out activities in specific operational processes.	C2 Using basic knowledge of human performance and limitations in promoting safety and efficiency in flight operations.	C3 Interpret the physical properties of the atmosphere and the factors affecting aviation operations.	C4 Integrated use of the standard communication procedures and phraseology to ensure efficient communication in air traffic services.	C5 State and describe basic aerodynamics principles for making carrying out duties more effectively.
KNOWLEDGE					
1. Use of the concepts, principles, processes and standards / regulations particular to a very specialized field of work or study.	C1.1 Description in details of the aviation legislation aspects and appropriate air traffic procedures primarily based on ICAO documentation and European Union regulations;	C2.1 Define in deep the principles of the basic aviation physiology and human performance including principles of threat and error management; Identification of the problem areas for pilots (food hygiene, intoxication, etc);	C3.1 Describe basic concepts of aeronautical meteorology; climatology of relevant areas in respect of the elements having an effect upon aviation; the movement of pressure systems, the structure of fronts, and the origin and characteristics of significant weather phenomena which affect take-off, en-route and landing conditions;	C4.1 Define the communication procedures and phraseology as applied to VFR / IFR operations;	C5.1 Implement appropriate pre-flight specific procedures for Visual flight rules, utilize basics of flying by sole reference to instruments, including limited panel and unusual attitudes.
2. Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C1.2 Using basic knowledge of the civil aviation regulations and common aviation safety regulations to perform operational procedures in accordance with the standards; State the rules and regulations relevant to the holder of a commercial pilot licence;	C2.2 Using basic aviation psychology standards in human factors for identifying problem areas for pilots, principles of communication: verbal and non-verbal communication; Focus on efficient management techniques and standards in health and fitness programs;	C3.2 Use basic knowledge for interpretation and application of aeronautical meteorological reports, charts and forecasts; use of, and procedures for obtaining, meteorological information, pre-flight and in-flight; altimetry;	C4.1 Using the basic knowledge of the of radiotelephony (RTF), generalize radar procedural phraseology in VFR communications;	C5.2 Using basic knowledge of general and radio navigation for specific pre-flight procedures in case of VFR/IFR flights and perform before flight calculation;
SKILLS					

3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C1.3 Applying basic principles to record details of all flights flown in a pilot logbook; Apply airport standards and regulations for managing operational activities;	C2.3 Applying basic aviation physiology standards and health maintenance for correlation between the human being, his aircraft and the flying environment;	C3.3 Apply a solution to any problems presented by weather conditions;	C4.3 Apply standard communications procedures and phraseology, air traffic services procedures and methods for efficient communication in operations to, from and transiting controls aerodromes;	C5.3 Applying basic principles and methods for preparation of pre-flight operations, mass and balance determination, aircraft inspection and servicing;
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C1.4 Use of the flight information service and alerting service or rescue and firefighting services, apron management service and follow standard procedures related to emergencies, communication failure and contingencies, report to TWR about operational failure or irregularity of AD equipment;	C2.4 Outline the concepts and error generation for avoiding and managing errors: cockpit management;	C3.4 Notification of the conditions for freezing/melting or another observed irregular weather condition;	C4.4 Focus on standard communication procedures in case of failure: apply action which need to be taken in communication failure in VFR flight.	C5.4 Notification in case of forced landing without power or engine failure, notice of choice landing area, provision for change of plan;
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	C1.5 Summarize the in flight information for operational reporting system (perform flight report) which provides possibility to report hazards or defects;	C2.5 Preparation of fatigue report in case of fatigue among pilot and cabin crew;	C3.5 Prepare a pilot report or PIREP which specify actual weather conditions encountered by an aircraft in flight;	C4.5 Follow action which need to be taken in case of communication failure;	C5.5 Report when aircraft ready to flight and perform all preparation;
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	The language of flight, or Aviation English is the de facto international language of civil aviation – and that pilots and air traffic controllers must have at least a basic knowledge of it. To ensure communications are clear and fully understood it is of vital importance that transmissions by radiotelephony should comply with internationally agreed procedures and phraseology. Communications shall be concise and unambiguous, using standard phraseology for all situations for which it is specified. Some abbreviations, which by their common usage have become part of aviation terminology, may be spoken using their constituent letters rather than the spelling alphabet, for example, ILS, QNH, RVR, etc., ATS abbreviations, Q-code groups commonly used in RTF air - ground communications, RTF call signs for aeronautical stations including use of abbreviated call signs; Messages will not be transmitted to an aircraft during take-off, the last part of final approach or the landing roll, unless it is necessary for safety reasons, because it will be distracting to the pilot at a time when the cockpit workload is often at its highest.				

AUTONOMY AND RESPONSIBILITY	
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures.	Execution of the flight plan, by making sure that the cargo has been loaded correctly, ensure fuel supply is adequate and that the weather conditions are acceptable after that submit flight plan to air traffic control; Operate and control aircraft along planned routes, during takeoffs/landings and navigate the aircraft by using cockpit instruments and visual references; Communicate with air traffic control over the aircraft's radio system and then contact the destination control tower as they approach to request landing permission and instructions; Monitor engines, fuel consumption, and other aircraft systems during flight and respond to any changes in weather or other events, such as engine failure;
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study.	Responsible execution of the preflight inspection - check aircraft prior to flights to ensure that the engines, controls, instruments, and other systems are functioning properly, especially after maintenance work, choose routes, fuel cantity, altitudes, and speeds that will provide the fastest, safest, and smoothest flights; calculate duty time, flight time and flight duty period,

	in order to comply with limits and requirements. Also perform the calculation of the rest period, ultimately, the pilot is responsible for the safety of the aircraft and needs to be aware of his or her fatigue threshold.
SOCIAL AND PERSONAL DEVELOPMENT	
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	Understanding the need for being aware of not only one's own performance but that of others before and during a flight and the possible consequences and/or risks; Achieving specific illustration of the purpose and procedure of checklists and procedure of crew briefings and in-flight crew collaboration;
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	Objective self-evaluation to improve weak points by recurrent training and checking for compliance with conditions for upgrade from co-pilot to commander and to meet the requirements of the differences training and/or familiarization training; Openness to a self-discipline, maintaining a healthy lifestyle and manage stress levels;
Minimum performance standards for competence assessment:	A pass in a theoretical knowledge examination paper will be awarded to an applicant achieving at least 75 % of the marks allocated to that paper. Related to flight training candidate shall have demonstrated the ability to perform as pilot-in-command with a degree of competency appropriate to the privileges granted to the holder of a commercial pilot licence, and to: a) recognize and manage threats and errors; b) operate the aircraft within its limitations; c) complete all manoeuvres with smoothness and accuracy; d) exercise good judgement and airmanship; e) apply aeronautical knowledge; and f) maintain control of the aircraft at all times in a manner such that the successful outcome of a procedure or manoeuvre is assured.

COMPETENCES / DESCRIPTORS	C6 Relate and implement standard operational procedure which need to be done before flight, in-flight and after flight to comply with safety practices.	C7 Establish, organize and control flight performance of the aircraft and adapt flight planning to existing condition.	C8 Identify and describe essential components of an aircraft and define systems needed to fly an aircraft efficiently and safely, whilst exercising proper maintenance of the airframe.	C9 Explain and trace the basic principles of general navigation and radio navigation which includes the process of planning, recording, and controlling the movement of a aircraft from one place to another.
KNOWLEDGE				
1. Use of the concepts, principles, processes and standards / regulations particular to a very specialized field of work or study.	C6.1 Describe operational procedures for carriage of freight, potential hazards associated with dangerous goods; General requirements and practices for safety briefing to passengers, including precautions to be observed when embarking and disembarking from aircraft;	C7.1 Define the methods and concepts for selection of departure and arrival routes and altitudes, pre-flight and en-route flight planning appropriate to commercial operations under VFR;	C8.1 Describe principles of operation and functioning of engines, systems and instruments; State the operating limitations of the relevant category of aircraft and engines; relevant operational information from the flight manual or other appropriate document; Identify the maintenance procedures for airframes, systems and engines of appropriate aircraft;	C9.1 Description in details concepts of air navigation, including the use of aeronautical charts, instruments and navigation aids; Describe principles and characteristics of appropriate navigation systems and operation of airborne equipment;
2. Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C6.2 Using basic knowledge to interpret laws, regulations and standard procedures, accident prevention and flight safety programme; Use the standards rules for refuelling/defueling of the aircraft;	C7.2 Use basic knowledge for flight planning VFR flights (find the data from the chart and transfer them to the navigation plan);	C8.2 Utilize information from Aircraft Flight Manual (AFM), Flight Crew Operating Manual (FCOM) to explain the outcome data selection and contribute on aircraft flight control systems;	C9.2 Use different standard communication channels, frequency assigned band for take - off and landing procedures, use of aeronautical charts;
SKILLS				
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C6.3 Apply airport safety procedures, signalling control procedures for performing preparation for and action after flight (flight authorisation and aeroplane acceptance, serviceability documents, equipment required, maps etc; external and internal checks;)	C7.3 Applying flight performance standards to perform routine flight operations checks, perform take-off and landing, cross-country flying using visual reference, dead reckoning and radio navigation aids, to perform flight planning for normal and abnormal conditions and ensure continuously flight monitoring;	C8.3 Applying basic principles to operate cockpit control panels, operate radar equipment, operate radio equipment, operate radio navigation instruments, operate two-way radio systems, and operate a multi engine aircraft;	C9.3 Application of general and radio navigation procedures to choice of route controlled airspace, to perform calculations of magnetic heading, time en-route, fuel consumption, mass and performance, etc;
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C6.4 Appropriate notifications in case of flight at critically low airspeeds, recognition of, and recovery from, incipient and full stalls, flight at critically height airspeeds, recognition of, and recovery from, spiral dive;	C7.4 Appropriate use of standard criteria and methods in crosswind take-offs and landings or short field and obstacle clearance; In the case of an emergency in-flight update, has to check the information	C8.4 Notification of the emergency operations, including simulated aeroplane equipment malfunction: action if fire on the ground and in the air, engine cabin and electrical system fire, systems failure, escape drills, location and use	C9.4 Notification in case of overflight in a danger, prohibited or restricted area, navigation problems at lower levels and reduced visibility;

		about alternate aerodrome, meteorological conditions, and final reserve fuel;	of emergency - equipment and exits; In time recognition of failure flags and messages;	
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	C6.5 Recognition of the situation as well as immediate memory actions in correct sequence and for those conditions recognized as emergencies by the manufacturer and competent authority for certification;	C7.5 Identifying the effects of loading and mass distribution on aircraft handling, flight characteristics and performance;	C8.5 Perform minor aircraft maintenance and repair work, or arrange for major maintenance;	C9.5
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	The language of flight, or Aviation English is the de facto international language of civil aviation – and that pilots and air traffic controllers must have at least a basic knowledge of it. To ensure communications are clear and fully understood it is of vital importance that transmissions by radiotelephony should comply with internationally agreed procedures and phraseology. Communications shall be concise and unambiguous, using standard phraseology for all situations for which it is specified. Some abbreviations, which by their common usage have become part of aviation terminology, may be spoken using their constituent letters rather than the spelling alphabet, for example, ILS, QNH, RVR, etc., ATS abbreviations, Q-code groups commonly used in RTF air - ground communications, RTF call signs for aeronautical stations including use of abbreviated call signs; Messages will not be transmitted to an aircraft during take-off, the last part of final approach or the landing roll, unless it is necessary for safety reasons, because it will be distracting to the pilot at a time when the cockpit workload is often at its highest.			
AUTONOMY AND RESPONSIBILITY				
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures.	Execution of the flight plan, by making sure that the cargo has been loaded correctly, ensure fuel supply is adequate and that the weather conditions are acceptable after that submit flight plan to air traffic control; Operate and control aircraft along planned routes, during takeoffs/landings and navigate the aircraft by using cockpit instruments and visual references; Communicate with air traffic control over the aircraft's radio system and then contact the destination control tower as they approach to request landing permission and instructions; Monitor engines, fuel consumption, and other aircraft systems during flight and respond to any changes in weather or other events, such as engine failure;			
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study.	Responsible execution of the preflight inspection - check aircraft prior to flights to ensure that the engines, controls, instruments, and other systems are functioning properly, especially after maintenance work, choose routes, fuel cantity, altitudes, and speeds that will provide the fastest, safest, and smoothest flights; calculate duty time, flight time and flight duty period, in order to comply with limits and requirements. Also perform the calculation of the rest period, ultimately, the pilot is responsible for the safety of the aircraft and needs to be aware of his or her fatigue threshold.			
SOCIAL AND PERSONAL DEVELOPMENT				
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	Understanding the need for being aware of not only one's own performance but that of others before and during a flight and the possible consequences and/or risks; Achieving specific illustration of the purpose and procedure of checklists and procedure of crew briefings and in-flight crew collaboration;			
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	Objective self-evaluation to improve weak points by recurrent training and checking for compliance with conditions for upgrade from co-pilot to commander and to meet the requirements of the differences training and/or familiarisation training; Openness to a self-discipline, maintaining a healthy lifestyle and manage stress levels;			

Minimum performance standards for competence assessment:	A pass in a theoretical knowledge examination paper will be awarded to an applicant achieving at least 75 % of the marks allocated to that paper. Related to flight training candidate shall have demonstrated the ability to perform as pilot-in-command with a degree of competency appropriate to the privileges granted to the holder of a commercial pilot licence, and to: g) recognize and manage threats and errors; h) operate the aircraft within its limitations; i) complete all manoeuvres with smoothness and accuracy; j) exercise good judgement and airmanship; k) apply aeronautical knowledge; and l) maintain control of the aircraft at all times in a manner such that the successful outcome of a procedure or manoeuvre is assured.

9.2.3 Description of Qualifications for Aircraft Maintenance Technician

9.2.3.1 Description for Training Programme CAT A Aircraft Maintenance Technician

Study Field ………………………………… **Training programme Aircraft Maintenance Technician**

Grid 1 – *Description of study programme/training by means of competences*

Qualification Title CAT A Aircraft Maintenance Technician (i.a.w Annex III to EU 1321/2014) Qualification Level: 5	Aircraft Line Maintenance Technician for turbine engine airplanes (Cat A1) Aircraft Line Maintenance Technician for piston engine airplanes (Cat A.2) Aircraft Line Maintenance Technician for turbine engine helicopters (Cat A.3) Aircraft Line Maintenance Technician for piston engine helicopters (Cat A4)					
INTEGRATED LEARNING OUTCOMES DESCRIPTORS	C1 PERFORM SIMPLE LINE CHECKS	C2 PERFORM SIMPLE LINE TESTS ON AIRCRAFT	C3 PERFORM SIMPLE MAINTENANCE TASKS I.A.W Annex II to EC 1321/2014	C4 CERTIFY SIMPLE MAINTENANCE TASKS		
KNOWLEDGE						
1. Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	C1.1 Basic and specific technical knowledge	C2.1 Specific aircraft task knowledge	C3.1 Maintenance standards knowledge	C4.1 Maintenance regulations knowledge		
3. . Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study. 4.	C1.2 Knowledge on maintenance documents types	C2.2 Recognition of proper maintenance task instructions	C3.2 Recognition of relevant maintenance documents	C4.2 Knowledge about specific tools and equipment		
SKILLS						
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C1.3 Identify corresponding maintenance tasks within the specific AMM (Aircraft Maintenance Manual)	C2.3 Interpretation of drawings and schemes	C3.3 Selection of necessary materials, tools and equipment	C4.3 Perform simple maintenance tasks		

4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C1.4 Recognize improper use of tools and devices	C2.4 Recognize improper conditions for using equipment, tools and control devices	C3.4 Identify malfunctions of usual equipment & tools	C4.4 Identify decalibration of tools and measuring devices		
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	N/A					
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C1.6 Communicate with the team using proper technical terms in manufacturer/ operator language	C2.6 Communicate with the crew using proper technical terms in manufacturer/ operator language				
AUTONOMY AND RESPONSIBILITY						
7. Exercise management and supervision in contexts of work or study activities where there is unpredictable change	C1.7 Work independently at locations where maintenance team support is not available					
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study	C1.8 Certify maintenance tasks					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	N/A					
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	C1.10 Attend new aircraft task training, recurrent training, perform maintenance task to ensure achievement of the requirements in Annex III to EU 1321/2014 for the issue and revalidation of the internal approval					
Minimum performance standards for competence assessment:	Technical basic education	Part 66 license endorsed with corresponding A category	Maintenance experience	Practical skills		

9.2.3.2 Description for Training Programme CAT B Aircraft Maintenance Technician

Study Field ……………………………… **Training programme Aircraft Line and Base Maintenance Technician**

Grid 1 – *Description of study programme/training by means of competences*

Qualification Title CAT B Aircraft Line and Base Maintenance Technician/Engineer i.a.w Annex III to EU 1321/2014 Qualification Level: 5	Aircraft Maintenance Technician/Engineer for turbine engine airplanes (Cat B1.1) Aircraft Maintenance Technician/Engineer for piston engine airplanes (Cat B1.2) Aircraft Maintenance Technician/Engineer for turbine engine helicopters (Cat B1.3) Aircraft Maintenance Technician/Engineer for piston engine helicopters (Cat B1.4)					
INTEGRATED LEARNING OUTCOMES DESCRIPTORS	C1 PERFORM IN-DEPTH INSPECTIONS	C2 SCHEDULE LINE MAINTENANCE CHECKS OPERATIONS	C3 PERFORM SIMPLE AND COMPLEX TESTS ON AIRCRAFT	C4 PERFORM MAINTENANCE TESTS	C5 RELEASE THE AIRCRAFT TO SERVICE	
KNOWLEDGE						
1. Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	C1.1 Basic and specific technical knowledge	C2.1 Specific aircraft type knowledge	C3.1 Maintenance standards knowledge	C4.1 Maintenance regulations knowledge	C5.1 Administrative knowledge	
2. . Use adequate documentation, catalogs and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C1.2 Knowledge on maintenance documents types	C2.2 Recognition of proper maintenance task instructions	C3.2 Recognition of relevant maintenance documents	C4.2 Knowledge about specific tools and equipment		
SKILLS						
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C1.3 Identify corresponding maintenance tasks within the specific AMM (Aircraft Maintenance Manual)	C2.3 Interpretation of drawings and schemes	C3.3 Selection of necessary materials, tools and equipment	C4.3 Perform non-routine complex maintenance checks	C5.3 Perform non-routine complex maintenance tasks	
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C1.4 Recognize improper use of tools and devices	C2.4 Recognize improper conditions for using equipment, tools and control devices	C3.4 Identify malfunctions of usual equipment & tools	C4.4 Identify decalibration of tools and measuring devices	C5.4 Identify incorrect maintenance	

5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	C1.5 Identify problems not listed in AMM and propose technical alternative solutions to be presented to the aircraft manufacturer	C2.5 Prepare technical reports for deferred maintenance tasks		C5.5 Prepare technical reports in case of incorrect maintenance and submit details for correction		
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C1.6 Communicate with the team using proper technical terms in manufacturer/ operator language	C2.6 Communicate with the crew using proper technical terms in manufacturer/ operator language	C3.6 Communicate with aircraft operator to inform about deferred maintenance tasks			
AUTONOMY AND RESPONSIBILITY						
7. Exercise management and supervision in contexts of work or study activities where there is unpredictable change	C1.7 Work independently at locations where maintenance team support is not available					
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study	C1.8 Certify maintenance tasks	C2.8 Certify maintenance work package	C3.8 Sign release to service of the aircraft			
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	C1.9 Participate in or coordinate teams for complex maintenance and shift changing management					
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	C1.10 Attend new aircraft type training, recurrent training, perform maintenance task to ensure achievement of the requirements in Annex III to EU 1321/2014 for the issue and revalidation of the internal approval					
Minimum performance standards for competence assessment:	Technical basic education	Part 66 license endorsed with corresponding B category and aircraft type(s)	Maintenance experience	Practical skills		

9.2.3.3 Description For training programme CAT C Aircraft Maintenance Technician

Study Field ……………………………… **Training programme** CAT C **Aircraft Base Maintenance Technician/Engineer i.a.w Annex III to EU**

Grid 1 – *Description of study programme/training by means of competences*

Qualification Title CAT C **Aircraft Base Maintenance Technician/Engineer i.a.w Annex III to EU 1321/2014** Qualification Level: **5**	**Category C is similar with Category B, the only differences being that category B can sign off only for line maintenance and Category C can sign off for base maintenance (for line maintenance work, category C is not required)** **Category C can be obtained by respecting theoretical requirements for B and from experience point of view:** **- either after 3 years of working and signing as a Category B technician,** **- either, for an applicant holding an academic degree in a technical discipline, from a university or other higher educational institution recognised by the competent authority, 3 years of experience working in a civil aircraft maintenance environment on a representative selection of tasks directly associated with aircraft maintenance including 6 months of observation of base maintenance tasks.** **Aircraft Base Maintenance Technician/Engineer**				
INTEGRATED LEARNING OUTCOMES DESCRIPTORS	**C1** **PERFORM IN-DEPTH INSPECTIONS**	**C2** **SCHEDULE LINE MAINTENANCE CHECKS OPERATIONS**	**C3** **PERFORM SIMPLE AND COMPLEX TESTS ON AIRCRAFT**	**C4** **PERFORM MAINTENANCE TESTS**	**C5** **RELEASE THE AIRCRAFT TO SERVICE (BASE)**
KNOWLEDGE					
1. Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	**C1.1** Basic and specific technical knowledge	**C2.1** Specific aircraft type knowledge	**C3.1** Maintenance standards knowledge	**C4.1** Maintenance regulations knowledge	C5.1 Administrative knowledge
2. . Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	**C1.2 Knowledge** on maintenance documents types	**C2.2 Recognition** of proper maintenance task instructions	**C3.2** Recognition of relevant maintenance documents	C4.2 Knowledge about specific tools and equipment	
SKILLS					
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	**C1.3** Identify corresponding maintenance tasks within the specific AMM (Aircraft Maintenance Manual)	**C2.3** Interpretation of drawings and schemes	**C3.3** Selection of necessary materials, tools and equipment	**C4.3** Perform non-routine complex maintenance checks	**C5.3** Perform non-routine complex maintenance tasks
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	**C1.4** Recognize improper use of tools and devices	**C2.4** Recognize improper conditions for using equipment, tools and control devices	**C3.4** Identify malfunctions of usual equipment & tools	**C4.4** Identify decalibration of tools and measuring devices	**C5.4** Identify incorrect maintenance

5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	C1.5 Identify problems not listed in AMM and propose technical alternative solutions to be presented to the aircraft manufacturer	C2.5 Prepare technical reports for deferred maintenance tasks		C5.5 Prepare technical reports in case of incorrect maintenance and submit details for correction	
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	**C1.6** Communicate with the team using proper technical terms in manufacturer/ operator language	C2.6 Communicate with the crew using proper technical terms in manufacturer/ operator language	C3.6 Communicate with aircraft operator to inform about deferred maintenance tasks		
AUTONOMY AND RESPONSIBILITY					
7. Exercise management and supervision in contexts of work or study activities where there is unpredictable change	**C1.7** Work independently at locations where maintenance team support is not available				
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study	**C1.8** Certify maintenance tasks	**C2.8** Certify maintenance work package	**C3.8** Sign release to service of the aircraft		
SOCIAL AND PERSONAL DEVELOPMENT					
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	**C1.9** Participate in or coordinate teams for complex maintenance and shift changing management				
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	**C1.10** Attend new aircraft type training, recurrent training, perform maintenance task to ensure achievement of the requirements in Annex III to EU 1321/2014 for the issue and revalidation of the internal approval				
Minimum performance standards for competence assessment:	Technical basic education	Part 66 license endorsed with corresponding C category and aircraft type(s)	Maintenance experience	Practical skills	

1.1.1 Description of Qualifications for Air Traffic Controllers

9.2.3.4 Description for Training Programme Ground Handling Traffic Technician

Study Field ……………………………… **Training programme Ground Handling Traffic Technician**

Grid 1 – *Description of study programme/training by means of learning outcomes and descriptors*

Qualification Title **Ground Handling Traffic Technician** Qualification Level: **5**	Existing and possible occupations				
COMPETENCES **DESCRIPTORS**	C1 Implementation of aviation legislation and knowledge for carrying out activities in specific operational processes	C2 Using knowledge on human factor in ground operations	C3 Interpret the physical properties of the atmosphere and the factors affecting aviation operations.	C4 Performing safety operational oversight	C5 State and describe the basic information on aircraft and its performances for load control purposes
KNOWLEDGE					
1. Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	**C1.1** Description on basic aviation legislation: the importance of aviation law, international organizations (ICAO, IATA, European Agencies, Aviation Associations), national organizations, safety regulations, customer service, passengers handling, cargo handling, load control, rules of the air, flight plan, aerodromes, service level agreements (SLAs), emergency response planning, cooperation with air traffic control services	**C2.1** Description of basic concepts of human factor in ground operations like: motivation and attitude, human behavior, communication skills, stress, ergonomics, effects of psychoactive substances (drugs and alcohol), fatigue, time pressure, peer management pressure, situational awareness, teamwork	**C3.1** Description of meteorology concepts, atmosphere, atmospheric circulation, meteorological phenomena, winter or slippery apron conditions , high wind conditions	**C4.1** Description of basic concepts of ramp safety, operational procedures, aircraft, vehicles and Ground Support Equipment operation and parking, baggage handling, cabin equipment de-icing/anti-icing services, departure control check, exterior/interior cleaning, load control document accuracy, marshalling, moving of aircraft, passengers services, passengers with reduced mobility, ramp	**C5.1** Recognizing and describing: basic information on aircraft, flight principles, aircraft categories, performances, aircraft loading principles, engine types, aircraft masses, different types of operational messages

				fuelling/defuelling operations, ramp services,	
2. Use adequate documentation, catalogs and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	**C1.2** Using essential definition, describe and match specific data, information and terms from various sources, from real professional contexts and literature, to the formulation of specific arguments, decisions and approaches related to aviation	**C2.2** Use basic information/concepts to interpret and analyze ground staff behavior, to develop proper company policies and programmes related on human factor in ground operations	**C3.2** Use information to interpret and analyse of different meteorological data and phenomena	**C4.2** Use related procedures and manuals in order to fulfill the tasks	**C5.2** Use basic knowledge in order to understand the principle of loading of aircrafts and to issue manual / electronic loadsheet
SKILLS					
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	**C1.3** Perform resources management, flight plan decoding, communication with airlines, agreements with airlines using IATA Standard Ground Handling Agreement, root cause analysis	**C2.3** Manage human resources having in view the human factor concepts	**C3.3** Analyze and interpret various meteorological conditions related to aircraft ground services (e.g. for de-icing/anti incing)	**C4.3** Managing various situation related to the areas described at C4.1	**C5.3** Issuing loadsheet and operational messages like load message, container/pallet message, etc
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	**C1.4** Notify and apply procedures related to precautionary and emergency procedures, including action to be taken to avoid operational hazards	**C2.4** Observe and notify personnel behavior in in order to prevent human factor occurences	**C3.4** Notification of different situations concerning the impact of weather condition on aircraft ramp operation using notification levels,	**C4.4** Reporting of incidents, accidents and near-misses related to operational safety according to the local/national/european legislation	**C5.4** Notification of any abnormal issue regarding using loadcontrol software
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports. .	**C1.5** Reporting misinterpretation of the rules and regulations	**C2.5** Report and coordonate various situations related to C.1 subjects	**C3.5** Use specific software and meteorological data interpretation of the results obtained, interpretation of meteorological hazards	**C4.5** Use different models for root cause analysis	**C5.5** Reporting any irregularity related to loadcontrol process

6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	**C1.6** Communicate with and report to according to the job description. Understanding and use of proper technical terms in English language at required level				
AUTONOMY AND RESPONSIBILITY					
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures sub	**C1.7** Work independently being familiarized with change management				
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study	**C1.8** The use of rigorous, efficient and responsible work strategies, punctuality and personal responsibility towards the outcome and the stages of obtaining it, based on the principles, norms and values of the code of professional ethics, the knowledge of the legislation, the ethical norms and the communication possibilities specific to the field .				
SOCIAL AND PERSONAL DEVELOPMENT					
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work.	C1.9 Familiarization with human factor issues like human performances (individual behaviour, safety culture, health and well-being, teamwork, stress management), human error, communication, work environment.				
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	C1.10 Proofing knowledge on studied items.				
Minimum performance standards for competence assessment:	Interpreting rules and regulation in the field of ground operations Decode-encode flight plans Specific terms definitions Explaining ground operations processes (ramp handling, passengers handling, baggage handling, cargo handling, etc)	Describing basic concepts on human factor in ground operations, conduct root cause analysis related to human factor	Explain, evaluate and assess information regarding atmosphere (composition, structure, heat and temperature, air pressure) atmospheric circulation (general air circulation, aisr masses and frontal systems, wind) meteorological phenomena (clouds, types of	Describe aircraft turnaround process, describe aircraft ground services and equipment used, decode specific acronyms, define ramp danger areas, describe the sequence of aircraft ground services	Demonstration of acquiring information regarding forces acting on aircraft, structural components and control an aircraft, recognising different aircraft categories, define load control basic concepts, issue a manual load sheet and a loading instruction report

			precipitation, visibility) by decoding /encoding messages		

9.2.3.5 Description for Training Programme Air Traffic Controller – Aerodrome Control Visual Rating (ADV)

Study Field ……………………………… **Training programme Air traffic controller rating APP**

Grid 1 – *Description of study programme/training by means of learning outcomes and descriptors*

Qualification Title Air Traffic Controller – Aerodrome Control Visual Rating (ADV) Qualification Level: 5	Existing and possible occupations					
COMPETENCES DESCRIPTORS	C1 Describe and define basic information on aerodromes airside	C2 Using basic knowledge on Air Traffic Management	C3 Interpret the physical properties of the atmosphere and the factors affecting aviation operations.	C4 Using the basic concepts of air navigation	C5 State and describe the basic information on aircraft and its performances	C6 Identify and describe essential components of the equipment and systems used in Air Traffic Control
KNOWLEDGE						
1. Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	C1.1 Recognizing and describing aerodrome data, layout and coordination, movement surface, Obstacles, runways and adjacent surfaces	C2.1 Description of basic concepts on Air Traffic Management, altimetry and level allocation, radiotelephony, Air Traffic Control, clearances and instructions, coordination, data display, separations, airborne collision avoidance systems and ground based safety nets, provision of an aerodrome control service	C3.1 Description of meteorology concepts, atmosphere, atmospheric circulation, meteorological phenomena, meteorological information for aviation	C4.1 Description of basic concepts of air navigation, Earth, maps, aeronautical maps, diagrams, instrumental navigation, performance based navigation	C5.1 Recognizing and describing basic information on aircraft, flight principles, aircraft categories, performances, engines type, aircraft systems and instruments	C6.1 Identifying and describing the Air Traffic Control equipment, radio communications, Air Traffic Services surveillance, radar, automatic dependence surveillance, multilateration, surveillance data processing, working places
2. Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C1.2 Using various terms and definitions regarding aerodrome data, layout and coordination, movement area, manoeuvring area and	C2.2 Using and analysing of specific data, information and terms from various sources, from real professional contexts related to air traffic management task	C3.2 Using and analysing of different meteorological equipment /systems / software	C4.2 Use basic concepts to describe the scope and usability of the navigation, position and movement of the Earth, system of coordinates, influence of	C5.2 Use basic information to describe the forces acting on aircraft, structural components of the aircraft, flight envelope, aircraft categories,	C6.2 Use basic knowledge to describe the main types of Air Traffic Control equipment, communication equipment (radio communication, voice

	runways, obstacle-free airspace around airports	instructions according to C2.1 subjects		wind, map making and projections, visual navigation, navigational aspects of flight planning, ground based systems, performance based applications.	aircraft engine types, different aircraft systems and instruments, factors affecting aircraft performance (take-off factors, climb factors, cruise factors, descent and initial approach factors, final approach and landing factors, economic factors, environmental factors)	communication between Air Traffic Services units / positions, data link communications, airline communications, surveillance concepts in Air Traffic Services, information about different types of radars.
SKILLS						
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C1.3 Perform various tasks related to aerodrome coordination	C2.3 Recognize different information related to subjects on C2.1	C3.3 Analyze and interpret various meteorological conditions for aviation	C4.3 Interpret air navigation maps and diagrams	C5.3 Managing various situations evaluating factors influencing aircraft performances	C6.3 Apply information to identify different types of ATC/ATS equipment and systems
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C1.4 Notification of incidents and procedures conflict related to aerodrome	C2.4 Notification on improper conditions of using equipment and systems	C3.4 Notification of different situations concerning the impact of weather condition on aircraft operation and improper conditions of meteorology equipment/system/ software	C4.4 Notify improper condition of air navigation tools/ system	C5.4 Notification of any abnormal issue regarding aircraft performances	C6.4 Reporting any failure regarding equipment and systems
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports. .	C1.5 Report misinterpretation of procedures related to aerodromes	C2.5 Report and coordonate various situations related to C.1 subjects	C3.5 Use specific software and meteorological data interpretation of the results obtained,	C4.5 Troubleshooting system failure	C5.5 Reporting misinterpretation of the related concepts	C6.5 Troubleshooting system/ equipment failure

			interpretation of meteorological hazards			
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	C1.6 Communicate with and report to according to the job description. Understanding and use of proper technical terms in English language at required level					
AUTONOMY AND RESPONSIBILITY						
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures sub	C1.7 Work independently being familiarized with change management					
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study	C1.8 The use of rigorous, efficient and responsible work strategies, punctuality and personal responsibility towards the outcome and the stages of obtaining it, based on the principles, norms and values of the code of professional ethics, the knowledge of the legislation, the ethical norms and the communication possibilities specific to the field .					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work.	C1.9 Familiarization with human factor issues like human performances (individual behavior, safety culture, health and well-being, teamwork, stress management), human error, communication, work environment.					
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	C1.10 Proofing knowledge on studied items.					
Minimum performance standards for competence assessment:	Describe rules and regulation in the field of aerodromes Decode-encode NOTAMs (notification to airman) Specific terms definitions	Describing different types of services, different types of clearances, different types of separations, elements on provision of an aerodrome control service	Explain, evaluate and assess information regarding atmosphere (composition, structure, heat and temperature, air pressure) atmospheric circulation	Select different units of measurement, interpreting coordinates director and distance, recognising and interpreting maps and charts used in aviation, identification of different	Demonstration of acquiring information regarding forces acting on aircraft, structural components and control an aircraft, flight envelope, recognising	Recognising different types of Air Traffic Control Equipment, different types of radars, decode different types of messages

			(general air circulation, air masses and frontal systems, wind) meteorological phenomena (clouds types of precipitation, visibility) by decoding /encoding messages	types/elements of instrument navigation (ground-based systems, satellite –based systems, intertial navigation systems), explanation of principles and benefits of area navigation	different aircraft categories, wake turbulence categories, ICAO approach categories, interpreting aircraft performance data, recognising different types of aircraft engines and type of fuels, aircraft systems, engine instruments, flight instruments and navigational instruments, factors affecting aircraft performance	

9.2.3.6 Description for Training Programme Air Traffic Controller Rating APP

Study Field ……………………………… **Training programme Air traffic controller rating APP**

Grid 1 – *Description of study programme/training by means of learning outcomes and descriptors*

Qualification Title **Air Traffic Controller – APPROACH CONTROL PROCEDURAL RATING (APP)** Qualification Level: **5**	Existing and possible occupations					
COMPETENCES **DESCRIPTORS**	C1 Describe and define basic information on aerodromes airside	C2 Using basic knowledge on Air Traffic Management	C3 Interpret the physical properties of the atmosphere and the factors affecting aviation operations.	C4 Using the basic concepts of air navigation	C5 State and describe the basic information on aircraft and its performances	C6 Identify and describe essential components of the equipment and systems used in Air Traffic Control
KNOWLEDGE						
1. Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	**C1.1** Recognizing and describing aerodrome data, layout and coordination, movement surface, Obstacles, runways and adjacent surfaces	**C2.1** Description of basic concepts on Air Traffic Management, altimetry and level allocation, radiotelephony, Air Traffic Control, clearances and instructions, coordination, data display, separations, airborne collision avoidance systems and ground based safety nets, provision of an aerodrome control service, holding procedures	**C3.1** Description of meteorology concepts, atmosphere, atmospheric circulation, meteorological phenomena, meteorological information for aviation	**C4.1** Description of basic concepts of air navigation, Earth, maps, aeronautical maps, diagrams, instrumental navigation, performance based navigation	**C5.1** Recognizing and describing: basic information on aircraft, flight principles, aircraft categories, performances, engines type, aircraft systems and instruments	**C6.1** Identifying and describing the Air Traffic Control equipment, radio communications, Air Traffic Services surveillance, radar, automatic dependence surveillance, multilateration, surveillance data processing, working places
2. Use adequate documentation, catalogs and standards for description and integration of the principles, norms,	**C1.2** Using various terms and definitions regarding	**C2.2** Using and analyzing of specific data, information	**C3.2** Using and analyzing of different	**C4.2** Use basic concepts to describe the scope and	**C5.2** Use basic information to describe the forces	**C6.2** Use basic knowledge to describe the main types

processes in a specialized field of work / study.	aerodrome data, layout and coordination, movement area, maneuvering area and runways, obstacle-free airspace around airports	and terms from various sources, from real professional contexts related to air traffic management task instructions according to C2.1 subjects	meteorological equipment /systems / software	usability of the navigation, position and movement of the Earth, system of coordinates, influence of wind, map making and projections, visual navigation, navigational aspects of flight planning, ground based systems, performance based applications.	acting on aircraft, structural components of the aircraft, flight envelope, aircraft categories, aircraft engine types, different aircraft systems and instruments, factors affecting aircraft performance (take-off factors, climb factors, cruise factors, descent and initial approach factors, final approach and landing factors, economic factors, environmental factors)	of Air Traffic Control equipment, communication equipment (radio communication, voice communication between Air Traffic Services units / positions, data link communications, airline communications, surveillance concepts in Air Traffic Services, information about different types of radars.
SKILLS						
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	**C1.3** Perform various tasks related to aerodrome coordination	**C2.3** Recognize different information related to subjects on C2.1	**C3.3** Analyse and interpret various meteorological conditions for aviation	**C4.3** Interpret air navigation maps and diagrams	**C5.3** Managing various situations evaluating factors influencing aircraft performances	**C6.3** Apply information to identify different types of ATC/ATS equipment and systems
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	**C1.4** Notification of incidents, procedures conflict	**C2.4** Notification on improper conditions of using equipment and systems	**C3.4** Notification of different situations concerning the impact of weather condition on aircraft operation and improper conditions of meteorology equipment/system/software	**C4.4** Notify improper condition of air navigation tools/ system	**C5.4** Notification of any abnormal issue regarding aircraft performances	**C6.4** Reporting any failure regarding equipment and systems

5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports. .	**C1.5** Report misinterpretation of procedures related to aerodromes	**C2.5** Report and coordinate various situations related to C.1 subjects	**C3.5** Use specific software and meteorological data interpretation of the results obtained, interpretation of meteorological hazards	**C4.5** Troubleshooting system failure	**C5.5** Reporting misinterpretation of the related concepts	**C6.5** Troubleshooting system/ equipment failure
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	**C1.6** Communicate with and report to according to the job description. Collaborative work within the same area of responsibility / between different areas of responsibility. Controller/pilot cooperation. Understanding and use of proper technical terms in English language at required level					
AUTONOMY AND RESPONSIBILITY						
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures sub	**C1.7** Work independently being familiarized with change management					
8. Assumption of the full responsability for the nature and quality of outputs in a specialized field of work or study	**C1.8** The use of rigorous, efficient and responsible work strategies, punctuality and personal responsibility towards the outcome and the stages of obtaining it, based on the principles, norms and values of the code of professional ethics, the knowledge of the legislation, the ethical norms and the communication possibilities specific to the field					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work.	C1.9 Familiarization with human factor issues like human performances (individual behavior, safety culture, health and well-being, teamwork, stress management), human error, communication, work environment.					
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	C1.10 Proofing knowledge on studied items.					

Minimum performance standards for competence assessment:	Describe rules and regulation in the field of aerodromes Decode-encode NOTAMs (notification to airman) Specific terms definitions	Describing diferent types of services, different types of clearances, different types of separations	Explain, evaluate and assess information regarding atmosphere (composition, structure, heat and temperature, air pressure) atmospheric circulation (general air circulation, air masses and frontal systems, wind) meteorological phenomena (clouds types of precipitation, visibility) by decoding /encoding messages	Select different units of measurement, interpreting coordinate sector and distance, recognising and interpreting maps and charts used in aviation, identification of different types/elements of instrument navigation (ground-based systems, satellite –based systems, intertial navigation systems), explanation of principles and benefits of area navigation	Demonstration of aquiring information regarding forces acting on aircraft, structural components and control an aircraft, flight envelope, recognising different aircraft categories, wake turbulence categories, ICAO approach categories, interpreting aircraft performance data, recognising different types of aircraft engines and type of fuels, aircraft systems, engine instruments, flight intriments and navigational instruments, factors affecting aircraft performance	Recognising different types of Air Traffic Control Equipment, different types of radars, decode different types of messages

9.2.3.7 Description for Training Programme Student Air Traffic Controller

Study Field ……………………………… **Training programme Air Traffic Controller – basic training**

Grid 1 – *Description of study programme/training by means of learning outcomes and descriptors*

Qualification Title **Student Air Traffic Controller** Qualification Level: **5**	Existing and possible occupations Student Air Traffic Controller					
COMPETENCES / **DESCRIPTORS**	C1 Implementation of aviation legislation for carrying out activities in specific operational processes.	C2 Using basic knowledge on Air Traffic Management	C3 Interpret the physical properties of the atmosphere and the factors affecting aviation operations.	C4 Using the basic concepts of air navigation	C5 State and describe the basic information on aircraft and its performances	C6 Identify and describe essential components of the equipment and systems used in Air Traffic Control
KNOWLEDGE						
1. Use of the concepts, principles, processes and standards / regulations particular to a specialized field of work or study.	**C1.1** Description on basic aviation legislation: the importance of aviation law, international organizations (ICAO, European Agencies, Aviation Associations), national organizations, Air Traffic Services safety, safety regulations, measurement units, rules of the air, airspace and Air Traffic Services Routes, flight plan, aerodromes, holding procedures for instrumental and visual flight rules, air traffic controller	**C2.1** Description of basic concepts of Air Traffic Management, altimetry and level allocation, radiotelephony, Air Traffic Control, clearances and instructions, coordination, data display, separations, airborne collision avoidance systems and ground based safety nets	**C3.1** Description of meteorology concepts, atmosphere, atmospheric circulation, meteorological phenomena, meteorological information for aviation	**C4.1** Description of basic concepts of air navigation, Earth, maps, aeronautical maps, diagrams, instrumental navigation, performance based navigation	**C5.1** Recognizing and describing: basic information on aircraft, flight principles, aircraft categories, performances, engines type, aircraft systems and instruments	**C6.1** Identifying and describing the Air Traffic Control equipment, radio communications, Air Traffic Services surveillance, radar, automatic dependence surveillance, multilateration, surveillance data processing, working places
2. Use adequate documentation, catalogs and standards for description and integration of the principles, norms,	**C1.2** Using essential definition, describe and match specific data, information and terms from	**C2.2** Use basic information to interpret and analyse of specific data, information and	**C3.2** Use information to interpret and analyse of different	**C4.2** Use basic concepts to describe the scope and usability of the	**C5.2** Use basic information to describe the forces acting on aircraft, structural	**C6.2** Use basic knowledge to describe the main types of Air Traffic Control

processes in a specialized field of work / study.	various sources, from real professional contexts and literature, to the formulation of specific arguments, decisions and approaches related to aviation	terms from various sources, from real professional contexts related to air traffic management task instructions according to C2.1 subjects	meteorological equipment /systems / software	navigation, position and movement of the Earth, system of coordinates, influence of wind, map making and projections, visual navigation, navigational aspects of flight planning, ground based systems, performance based applications.	components of the aircraft, flight envelope, aircraft categories, aircraft engine types, different aircraft systems and instruments, factors affecting aircraft performance (take-off factors, climb factors, cruise factors, descent and initial approach factors, final approach and landing factors, economic factors, environmental factors)	equipment, communication equipment (radio communication, voice communication between Air Traffic Services units / positions, data link communications, airline communications, surveillance concepts in Air Traffic Services, information about different types of radars.
SKILLS						
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	**C1.3** Perform flight plan decoding, manage airspace and Air Traffic Services routes, manage holding procedures for instrumental flight rules and visual flight rules flights	**C2.3** Recognize different information related to subjects on C2.1	**C3.3** Analyze and interpret various meteorological conditions for aviation	**C4.3** Interpret air navigation maps and diagrams	**C5.3** Managing various situations evaluating factors influencing aircraft performances	**C6.3** Apply information to identify different types of ATC/ATS equipment and systems
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	**C1.4** Notify and apply procedures related to precautionary and emergency procedures, including action to be taken to avoid hazardous weather, wake turbulence and other operating hazards	**C2.4** Notification on improper conditions of using equipment and systems	**C3.4** Notification of different situations concerning the impact of weather condition on aircraft operation and improper conditions of meteorology equipment/ system/ software	**C4.4** Notify improper condition of air navigation tools/ system	**C5.4** Notification of any abnormal issue regarding aircraft performances	**C6.4** Reporting any failure regarding equipment and systems

5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports. .	**C1.5** Reporting misinterpretation of the rules and regulations	**C2.5** Report and coordonate various situations related to C.1 subjects	**C3.5** Use specific software and meteorological data interpretation of the results obtained, interpretation of meteorological hazards	**C4.5** Troubleshooting system failure	**C5.5** Reporting misinterpretation of the related concepts	**C6.5** Troubleshooting system/ equipment failure
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	**C1.6** Communicate with and report to according to the job description. Understanding and use of proper technical terms in English language at required level					
AUTONOMY AND RESPONSIBILITY						
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures sub	**C1.7** Work independently being familiarized with change management					
8. Assumption of the full responsability for the nature and quality of outputs in a specialized field of work or study	**C1.8** The use of rigorous, efficient and responsible work strategies, punctuality and personal responsibility towards the outcome and the stages of obtaining it, based on the principles, norms and values of the code of professional ethics, the knowledge of the legislation, the ethical norms and the communication possibilities specific to the field .					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work.	C1.9 Familiarization with human factor issues like human performances (individual behavior, safety culture, health and well-being, teamwork, stress management), human error, communication, work environment.					
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	C1.10 Proofing knowledge on studied items.					

Minimum performance standards for competence assessment:	Interpreting rules and regulation in the field of air transport Decode-encode flight plans Specific terms definitions	Describing different types of services, different types of clearances, different types of separations	Explain, evaluate and assess information regarding atmosphere (composition, structure, heat and temperature, air pressure) atmospheric circulation (general air circulation, air masses and frontal systems, wind) meteorological phenomena (clouds types of precipitation, visibility) by decoding /encoding messages	Select different units of measurement, interpreting coordinate sector and distance, recognising and interpreting maps and charts used in aviation, identification of different types/elements of instrument navigation (ground-based systems, satellite – based systems, intertial navigation systems), explanation of principles and benefits of area navigation	Demonstration of acquiring information regarding forces acting on aircraft, structural components and control an aircraft, flight envelope, recognising different aircraft categories, wake turbulence categories, ICAO approach categories, interpreting aircraft performance data, recognising different types of aircraft engines and type of fuels, aircraft systems, engine instruments, flight intriments and navigational instruments, factors affecting aircraft performance	Recognising different types of Air Traffic Control Equipment, different types of radars, decode different types of messages

9.3 Qualification Level 6 (bachelor)

9.3.1 Description for Training Programme Airline Transport Pilot Licence (ATPL)

Study Field ……………………………… **Training programme Airline Transport Pilot Licence (ATPL)**

Grid 1 – *Description of study programme/training by means of learning outcomes*

Qualification Title Airline Transport Pilot Licence (ATPL) Qualification Level: **6**	Existing and possible occupations				
COMPETENCES **DESCRIPTORS**	C1 Implementation of aviation legislation for carrying out activities in specific operational processes.	C2 Using basic knowledge of human performance and limitations in promoting safety and efficiency in flight operations.	C3 Interpret the physical properties of the atmosphere and the factors affecting aviation operations.	C4 Integrated use of the standard communication procedures and phraseology to ensure efficient communication in air traffic services.	C5 State and describe basic aerodynamics principles for making carrying out duties more effectively.
KNOWLEDGE					
1. Use of the concepts, principles, processes and standards / regulations particular to a very specialized field of work or study.	C1.1 Detailed identification of the rules and regulations relevant to the holder of an airline transport pilot licence; Description of appropriate air traffic services practices and procedures, altimeter setting procedures, the role of the aeronautical information service, detailed aerodromes design and operations; Description of the procedures for air navigation services – aircraft operations, separation methods and minima;	C2.1 Define the principles of threat and error management, the aviation physiology and health maintenance, human error and reliability, human behaviour in critical situation, the effect of high-altitude environment (ozone, radiation, humidity, extreme temperatures), fatigue management and relate body rhythm and sleep. State the multi-crew concepts: illustrate the decision making process and methods for avoiding the errors: cockpit management and risks	C3.1 Defining and describing in details the aeronautical meteorology, climatology of relevant areas in respect of the elements having an effect upon aviation, the movement of pressure systems, explain the structure of fronts, and the origin and characteristics of significant weather phenomena which affect take-off, en-route and landing conditions.	C4.1 Describe VFR/IFR communications principles, transmission of letters, transmission of numbers (including level info), transmission of time, transmission technique; Provide standard words and phrases (relevant Radiotelephony (RTF) phraseology included) in radiotelephony communications, Morse code;	C5.1 The description, methods for pre-flight procedures for IFR flights and/or VFR rules focused on the basics of flying by sole reference to instruments, including limited panel and unusual attitudes; Describe the principles of high-speed aerodynamics (speed of sound, mach number, shock waves, etc);

		associated with dispersion and/ or channelled attention during the application of procedures requiring a high workload within a short time frame (e.g. a go-around).			
2. Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C1.2 Use basic knowledge of civil aviation regulations, to explain and interpret operational procedures required by specific regulations at national / community / international level.	C2.2 Use basic knowledge to explain and interpret the new challenges in human factors, identify problem areas for pilots; Apply Crew Resource Management principles and standards in work process;	C3.2 Use basic knowledge to interpret and apply aeronautical meteorological reports, charts and forecasts; codes and abbreviations; Use of, and procedures for obtaining, meteorological information, pre-flight and in-flight;	C4.1 Use standard communication principles and essential speaking skill in communication with air traffic control before take-off and during flight and landing;	C5.2 Use basic knowledge for standard pre-flight procedures for IFR flights or VFR flights and provide before / in - flight calculation;
SKILLS					
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C1.3 Ability to record details of all flights flown in a pilot logbook and monitor duty time, applying procedures of dating and signing the completion of the aircraft technical log before, in-flight and after flight in compliance with civil aviation regulations;	C2.3 Applying basic aviation physiology standards and health maintenance for multi - tasking and good coordination, developing an ability to quickly respond (with the hand, finger, or foot) to a signal (sound, light, picture) when it appears;	C3.3 Utilize information which may affect a given flight and analyse and evaluate available weather information before flight as well as that collected in flight, recognition and effects of icing, frontal zone penetration procedures, hazardous weather avoidance;	C4.3 Applying standard communication to ensure efficient communication in air traffic services and follow standard communication in case of go-around, missed approach;	C5.3 Application of procedures in case of special circumstances (ice, contamination, etc), establish operating limitations and execution of pre-flight operations, including mass and balance determination, aircraft inspection, acceptance and servicing;
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C1.4 Notification of the operational failure or irregularity of AD equipment which shall be reported to the TWR immediately, report of illegal activity (e.g. bomb-threat, wilful damage or hi-jacking);	C2.4 Control avoiding and managing errors: cockpit management procedure; Notification of pilot incapacitation (e.g. as a result of illness);	C3.4 Notification of rapidly changing weather situation or aircraft damage (e.g. as a result of collision, bird strike or extreme weather);	C4.4 Following standard communication procedures in case of failure: action to be taken in communication failure on an IFR flight / VFR flight;	C5.4 Notification of forced landing without power or engine failure: forced landing procedure; choice of landing area, provision for change of flight plan;

DESCRIPTORS / COMPETENCES	C6 Relate and implement standard operational procedure which need to be done before flight, in-flight and after flight to comply with safety practices.	C7 Establish, organize and control flight performance of the aircraft and adapt flight planning to existing condition.	C8 Identify and describe essential components of an aircraft and define systems needed to fly an aircraft efficiently and safely, whilst exercising proper maintenance of the airframe.	C9 Explain and trace the basic principles of general navigation and radio navigation which includes the process of planning, recording, and controlling the movement of a aircraft from one place to another.
KNOWLEDGE				
1. Use of the concepts, principles, processes and standards / regulations particular to a very specialized field of work or study.	C6.1 Defining all-weather operations procedures, application of threat and error management to operational performance precautionary and emergency procedures; Identification and detailed description of the operational procedures for carriage of freight and dangerous goods, state requirements and practices for safety briefing to passengers, including precautions to be observed when embarking and disembarking from aircraft;	C7.1 Description of the effects of loading and mass distribution on aircraft handling, flight characteristics and performance, Description of concepts, principles, theorems and methods for mass and balance calculations, fuel-calculation, the additional fuel quantity, use and practical application of take-off, landing and other performance data, including procedures for cruise control;	C8.1 Describe and identify every part of the aircraft in detail, explain general characteristics and limitations of electrical, hydraulic, pressurization and other aircraft systems; Detailed description of the flight control systems, including autopilot and stability augmentation; State the principles of operation, handling procedures and operating limitations of aircraft engines, illustrate effects of atmospheric conditions on engine performance;	C9.1 Identification of concepts, theories, basic methods and principles of air navigation, including the use of aeronautical charts, radio navigation aids and area navigation systems, specific navigation requirements for long-range flights; Describe principles and characteristics of self-contained and external-referenced navigation systems, operation of airborne equipment;
2. Use adequate documentation, catalogues and standards for description and integration of the principles, norms, processes in a specialized field of work / study.	C6.2 Using knowledge to interpret and use of aeronautical documentation such as AIP, NOTAM, aeronautical codes and abbreviations; Utilize knowledge to comply with accident prevention and flight safety programme, maintenance release procedures, rules for refueling/defueling of the aircraft,	C7.2 Use basic knowledge for pre-flight and en-route operational flight planning, preparation and filing of air traffic services flight plans; Apply appropriate air traffic services procedures, altimeter setting procedures;	C8.2 Use knowledge to interpret relevant operational information from the flight manual or other appropriate document; Using specialized knowledge to perform serviceability checks of equipment and systems of appropriate aircraft;	C9.2 Explain, interpret and apply information from aeronautical charts; Use limitation and serviceability of avionics and instruments necessary for the control and navigation of aircraft; Use accuracy and reliability of navigation systems used in departure, en-route, approach and landing phases of flight;

SKILLS				
3. Execution of complex tasks within a specialized field of work or study, using technical documentation and tools for measuring / monitoring technological processes in normal new or changing conditions.	C6.3 Applying basic airport safety procedures, signalling control procedures; Apply procedures and methods in accordance with aeronautical regulations for action before and after flight (flight authorisation and aeroplane acceptance, serviceability documents, equipment required, maps etc; external and internal checks);	C7.3 Applying basic principles to perform take-off and landing, execute flight planning for normal and abnormal conditions;	C8.3 Applying basic principles to operate cockpit control panels, operate radar equipment, operate radio equipment, operate radio navigation instruments, operate two-way radio systems and operate a multi engine aircraft;	C9.3 Applying basic principles and characteristics of self-contained and external-referenced navigation systems, operation of airborne equipment;
4. Prompt notification of failure to use equipment, measuring and control devices and regulations specific to a specialized field of work or study.	C6.4 Notification of flight at critically low airspeeds, recognition of, and recovery from, incipient and full stalls; or notification of flight at critically high airspeeds, recognition of, and recovery from, spiral dive; Notification in case of shortage of fuel (or other essential consumable substance), follow standard procedure in case of reject take-offs, go-around, missed approach;	C7.4 Notify critical crosswind in stage of take-offs and landings, short-field landings, demand fuel quantity;	C8.4 Declare emergency operations situation, including aeroplane equipment/ component failure or malfunction, fire on board, etc; Recognize failure flags and messages.	C9.4 Alert of navigation problems at lower levels and reduced visibility or flight in danger, prohibited and restricted area;
5. Solving problems of work or study in a specialized field, possibly developing creative approaches, preparing technical documents and progress reports.	Provide operational report in accordance with establish system (perform flight report) for hazard or occurrence situation and filling in journey logbook which offers possibility to report passenger's behaviour or defects of the equipment in passenger cabin; Verify, filling in and evaluate notice in aircraft logbook, noting any incidents or problems observed during the flight;			
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	The language of flight, or Aviation English is the de facto international language of civil aviation – and that pilots and air traffic controllers must have at least a basic knowledge of it. To ensure communications are clear and fully understood it is of vital importance that transmissions by radiotelephony should comply with internationally agreed procedures and phraseology. Communications shall be concise and unambiguous, using standard phraseology for all situations for which it is specified. Some abbreviations, which by their common usage have become part of aviation terminology, may be spoken using their constituent letters rather than the spelling alphabet, for example, ILS, QNH, RVR, etc., ATS abbreviations, Q-code groups commonly used in RTF air - ground communications, RTF call signs for aeronautical stations including use of abbreviated call signs;			

	Messages will not be transmitted to an aircraft during take-off, the last part of final approach or the landing roll, unless it is necessary for safety reasons, because it will be distracting to the pilot at a time when the cockpit workload is often at its highest.
AUTONOMY AND RESPONSIBILITY	
7. Exercise management and supervision in contexts of work or study activities where there is predictable work, assuming responsibility to the quality of processes and procedures.	The Airline Transport Pilot is responsible for establishing the flight plan by making sure that the cargo has been loaded correctly, ensure fuel supply is adequate and that the weather conditions are acceptable after that submit flight plan to air traffic control; Operate and control aircraft along planned routes, and during take-offs, and landings; Navigate the aircraft by using cockpit instruments and visual references; Communicate with air traffic control over the aircraft's radio system and then contact the destination control tower as they approach to request landing permission and instructions; Monitor engines, fuel consumption, and other aircraft systems during flight and respond to any changes in weather or other events, such as engine failure; Check the overall condition of the aircraft before and after every flight; Brief and maintain regular contact with the cabin crew throughout the flight; React appropriately to ensure the safety of passengers and crew during emergencies and adverse circumstances; Communicate with passengers at periodic intervals during the flight;
8. Assumption of the full responsibility for the nature and quality of outputs in a specialized field of work or study.	Airline pilots have full control and responsibility for the overall safety, efficiency and smooth operation of the flights also need to perform pre-flight inspection - check aircraft prior to flights to ensure that the engines, controls, instruments, and other systems are functioning properly, especially after maintenance work. Pilot need to sign before every flight the aircraft acceptance for flight, so he/she confirms that the aircraft is operable and safe; Full responsibility of routes, fuel quantity, altitudes, and speeds that will provide the fastest, safest, and smoothest flights; Calculate duty time, flight time and flight duty period, in order to comply with limits and requirements; Also perform the calculation of the rest period, ultimately, the pilot is responsible for the safety of the aircraft and needs to be aware of his or her fatigue threshold; Make decision in case of abnormal situation: reject take-offs, go-around, missed approach;
SOCIAL AND PERSONAL DEVELOPMENT	
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels of a specialized field of work	Achieving leadership skills, with the ability to give clear commands during and determine the major obstacles to effective communication, create communication based on dialogue, co-operation, pro-active attitude and respect for others crew members;
10. Assuming a personal and professional development long-term plan and affirmation of the spirit of initiative and entrepreneurship in personal development and career management	Self-control of learning and efficient use of language skills and knowledge of information and communication technology; Recognizing and improve weak points by recurrent training and checking; Meet requirement for conversion training and checking, for differences training and familiarisation training; Develop a self-discipline, maintaining a healthy lifestyle and manage stress levels;
Minimum performance standards for competence assessment:	A pass in a theoretical knowledge examination paper will be awarded to an applicant achieving at least 75 % of the marks allocated to that paper. In flight training shall have demonstrated the ability to perform, as pilot-in-command of an aircraft within the appropriate category required to be operated with a co-pilot, the following procedures and manoeuvres: a) pre-flight procedures, including the preparation of the operational flight plan and filing of the air traffic services flight plan; b) normal flight procedures and manoeuvres during all phases of flight; c) abnormal and emergency procedures and manoeuvres related to failures and malfunctions of equipment, such as

	engine, systems and airframe; d) procedures for crew incapacitation and crew coordination, including allocation of pilot tasks, crew cooperation and e) use of checklists;

9.3.2 Description of Qualifications for Engineering Sciences

9.3.2.1 Description for Study Programme Aerospace Constructions

Study Field ENGINEERING SCIENCES **Study Programme AEROSPACE CONSTRUCTIONS**

Grid 1 – *Description of study programme by qualification…… bymeans of learning outcomes and descriptors*

Qualification Title **Aerospace Constructions** Qualification Level: **6 - BACHELOR**	Existing and possible occupations: Possible occupations, according to COR Aircraft Engineer - 214506, Aviation Engineer 213506, Aircraft Reception and Control Engineer 214417, Aircraft Engineer Designer 214537, Aircraft Reception and Control Engineer 214417, Head of Service, Centre, Station, Airport and Assimilated 122646, Mechanical Aircraft Aviation Engines 214527 , Aviation Technician 311404, Civil Aviation Traffic Controller 314403, Aviation Mechanic 723201, Teacher in Gymnasium (with the condition of 30 credits accruing to psycho-pedagogical disciplines). ● New occupants proposed to be included in COR:

COMPETENCES / **DESCRIPTORS**	Using knowledge from the fundamental disciplines of engineering in conducting calculations, demonstrations and applications, to solve engineering tasks: Applicant of fundamental knowledge in engineering.	Selection, combining and use of knowledge, principles and methods in the field of system engineering and aerospace engineering through functional schemes and graphical representations to solve domain specific tasks: user of engineering graphics, functional schemes and system engineering methods.	Use of programming languages and environments, software applications and information technology to solve specific tasks for aerospace engineering: user of specific software applications.	Form Design and Performance Assessment, Stability and Manoeuvrability of Flight Instruments: Aerodynamics and Flight Dynamics Specialist.	Design and testing of elements of the primary metallic and composite structure, hydropneumatics dashboard installations: aerospace and aircraft designer.	Design. technological, planning and exploitation of manufacturing systems, ensuring the operation of the airport in accordance with international aeronautical regulations and quality manuals: technologist, organizer and user of aeronautical technology.
KNOWLEDGE						
1. Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area;	Appropriate identification of basic principles, theorems and basic methods in mathematics, technical drawing and programming of computers, physical and theoretical models in physics, chemistry and	Defining the principles and methods in the basic sciences of aerospace engineering associated with graphic representations-technical drawing, computational	Identification of the solver model according to the target application, the methods of different approximation levels in the field of numerical computing specific to the aerospace constructions	Identifying the concepts, theories, methods and basic principles of fluid dynamics, aerodynamics, flight dynamics and stabilization.	Description of concepts, theories, methods and basic principles of designing aerospace structures by methods and procedures specific to elastic structures with thin walls.	Description of basic concepts, theories, methods and principles of planning, management and operation of processes, manufacturing systems, and airport activity as well as product quality assurance and inspection.

	mechanics of continuous environments, as well as their proper use in professional communication.	graphics, functional schemes.	and the proper processing for the professional communication.			
2 Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	Use basic knowledge of fundamental disciplines to explain and interpret the theoretical results in relation to experimental theories, phenomena or processes specific to the field of aerospace engineering.	Using knowledge from basic engineering sciences to explain and interpret the theoretical and / or experimental results, the airplane as a system, phenomena or processes, general and aerospace engineering detail drawings.	Using the basic knowledge associated with software and digital technologies to explain and interpret demonstrations, numerical computations dedicated to aerospace engineering, assisted graphics, and explanation and interpretation of situations by reference to experimental results or type problems.	Using basic knowledge to explain and interpret the different types of flight regimes and aircraft developments achieved through aerodynamic aerodynamics and aerodynamics specific aerodynamics and procedures and flight dynamics.	Using basic knowledge to explain and interpret different types of structural concepts.	Using basic knowledge to explain and interpret problems that arise in planning, managing and operating processes, manufacturing systems, airport activity as well as quality assurance and product inspection.
SKILLS						
3. Application of advanced principles and methods to solve complex and unpredictable problems/situations that are typical to the field of work /study.	Applying basic theorems, principles and methods of basic disciplines for basic calculations in the design and operation of technical systems, specific to aerospace engineering, in conditions of qualified assistance	Applying basic theorems, principles and methods of basic disciplines for basic calculations in the design and operation of technical systems, specific to aerospace engineering, in conditions of qualified assistance	Application of basic principles and methods of software and digital technologies for programming, database development, assisted graphics, modelling, computer-aided design of configurations and structures, computerized investigation and computerization of data specific to aerospace engineering, and aerospace constructions in particular under the	Apply basic principles and methods for designing aerodynamic configurations to assess performance and flight stability.	Applying the basic principles and methods for designing and designing aerospace structures with well-defined input data under qualified assistance conditions.	Applying the basic principles and methods for the planning, management and exploitation of manufacturing processes and systems, as well as for quality assurance and product inspection under qualified support conditions.

			conditions of qualified assistance.			
4 Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	Appropriate use of standard criteria and methods of assessment, from fundamental disciplines, for qualitative and quantitative identification, modelling, analysis and qualitative and quantitative assessment of specific phenomena and parameters, as well as for the processing and interpretation of results, from processes specific to aerospace engineering.	Appropriate use of standard criteria and methods of assessment in basic engineering sciences for the identification, modelling, experimentation, analysis and qualitative and quantitative assessment of defining aspects, phenomena and parameters, as well as for the collection of data and the processing and interpretation of the results, from processes specific to aerospace engineering	Appropriate use of standard criteria and assessment methods to assess the quality, efficiency and accuracy of software program results for the accomplishment of tasks specific to aerospace engineering in general and specifically aerospace constructions.	Appropriate use of standard criteria and assessment methods to assess the quality, benefits and limitations of aerospace configurations projects and to evaluate stability performance analysis.	Appropriate use of standard criteria and methods of assessment to assess the quality, advantages and limitations of hydro-pneumatic and electrical board design methods.	Appropriate use of standard evaluation criteria and methods to assess the quality, benefits and limitations of the planning, management and operation methods of manufacturing processes and systems as well as quality assurance and product inspection.
5. Development of professional and/or research projects using well known principles, methods and software within the field	Developing models and professional projects specific to aerospace engineering based on the identification, selection and use of principles, optimal methods and established solutions from the fundamental disciplines.	Developing professional projects specific to aerospace engineering based on selecting, combining and using the knowledge, principles and methods of the basic sciences of aerospace engineering and their association with integrated system representations, graphic design and functional schemes.	Developing professional projects specific to aerospace engineering in general and aerospace constructions, in particular, based on the selection, combination and use of principles, methods, digital technologies, computer systems and software tools established and compliant with aerospace regulations.	Development of professional aerodynamic projects, flight dynamics and stability through dedicated methods and procedures.	Elaboration of professional projects of aeronautical structures through dedicated methods and procedures.	Develop professional projects with the use of established principles and methods in the field of planning, management and operation of processes and manufacturing systems, as well as quality assurance and product inspection.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Standard: Optimal computational solving and complex problems related to the core engineering disciplines in the field of	Standard: Optimal solution of complex problems requiring the corroboration of knowledge in the technical sciences of the aerospace field with	Standard: Optimal engineering problem solving, database management, experimental data processing and 2D and 3D modelling, mainly	Standard: optimal design of aerodynamic airplane configurations, rocket or other industrial application and assessment of	Standard: the optimal design and design of a basic structure, under certain imposed data.	Standard: Optimal resolution of issues relating to planning, management and operation of processes and manufacturing systems, as well as product quality assurance and inspection.

	aerospace engineering tasks Minimum level: Correct solving of mathematical and physical complexity and physical complexity problems, specific to aerospace engineering.	graphic representations - technical drawing. Minimum level: Correct solving of medium complexity problems in the field of aerospace engineering, correct recognition and choice of materials for aeronautical applications, as well as correct reading, interpretation and representation of functional schemes, technical drawings of medium complexity, including specifying technical conditions and the association between the prescribed characteristics and the functional role of the subsystems.	in the field of aerodynamics and structure calculation. Minimum level: Correct solving of engineering problems, medium complexity, programming, database management, experimental data processing and 2D and 3D modelling, mainly in the field of aerodynamics and structural calculation.	performance and flight stability. Minimum level: correct design of aerodynamic airplane or rocket configurations, medium complexity, and assessment of performance and flight stability, under certain imposed conditions.	Minimum level: conception and design of a basic structure, of medium complexity, in conditions of imposed data.	Minimum level: correct solving of average complexity issues related to planning, management and operation of manufacturing processes and systems as well as quality assurance and product inspection
AUTONOMY AND RESPONSABILITY						
7. Supervision and assistance in managing complex technical or professional activities or projects	Execution of professional tasks under conditions of limited autonomy and qualified assistance, based on documentation, convergent and divergent logical reasoning, practical applicability, evaluation, self-evaluation and optimal decision.					
8. Take responsibility for decision-making in predictable, unpredictable work or study context	Responsible execution of professional tasks, with respect to the values and ethics of the engineer profession, based on documentation, convergent and divergent logical reasoning, practical applicability, evaluation, self-evaluation and optimal decision: executor responsible for professional tasks.					

<table>
<tr><td>SOCIAL AND PERSONAL DEVELOPMENT</td><td colspan="6"></td></tr>
<tr><td>9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.</td><td colspan="6">Achieving specific activities and roles for teamwork on different responsibilities and distributing tasks for subordinate levels, based on communication and dialogue, co-operation, pro-active attitude and respect for others: communication skills and teamwork.</td></tr>
<tr><td>10. Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.</td><td colspan="6">Objective self-evaluation of the need for professional development and openness to lifelong learning as well as effective use of language skills, knowledge of information and communication technology for personal and professional development: aware of the need for continuous training.</td></tr>
<tr><td>Minimum performance standards for integrated learning outcomes assessment:</td><td>Standard: Achieving and sustaining the quality of the year projects and the bachelor project.</td><td>Minimum level: Performing year projects and homework of medium complexity and the bachelor project, with the correct use of bibliographic sources, norms, standards and specific methods, under conditions of limited autonomy and qualified assistance, as well as supporting them with the demonstration the capacity of qualitative and quantitative evaluation of technical solutions in the field and of its own results.</td><td>Standard: group work of projects or projects with the identification and description of professional roles at the team level.</td><td>Minimum level: performing group projects or projects of medium complexity with the proper identification and description of the professional roles at the team level and respecting the main attributes of team work.</td><td>Standard: Identification of the need for professional training, critical analysis of training and professional development, and efficient use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.).), including using foreign languages, participation in internal and international student and student internship sessions and internships, internships for the internship period.</td><td>Minimum level: Identify the need for professional training with a satisfactory analysis of their own training and professional development and the appropriate use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.). .), including using at least one foreign language.</td></tr>
</table>

9.3.2.2 Description for Study Programme Aviation Equipment and Installations

Study Field ENGINEERING SCIENCES **Study Programme AVIATION EQUIPMENT AND INSTALLATIONS**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title **Aviation equipment and installations** Qualification Level: **6 - BACHELOR**	Existing and possible occupations: ● Possible occupations according to COR: Aircraft Engineer-214506, Research Engineer in Airborne Equipment and Plants-251511, Aircraft Engineer-214537 Engineer for Air Navigation Protection (Communications, Navigation, Surveillance) - 214548, Engineer / Inspector Specialist / Specialist / Expert in Air Traffic Services-214437, Aeronautical Inspector-214434, Engineer / Specialist Inspector / Specialist / Air Traffic Services Expert-214437, Aircraft Reception and Control Engineer - 214417, Engineer electromechanical - 214420; Electromechanical engineer - 214421; Mechanical engineer - 214501, Mechanical engineer designer - 214538, Mechanical engineering engineer - 214509, Electrical engineer-214312, Power engineering engineer 214305, Engineer of power engineering designer-214311, Distribution network dispatcher-214303, Civil aviation traffic controller - 314403, Pilot engineer test - 214540, Teacher of secondary education (provided 30 points credit for psycho-pedagogical mode) ● New jobs proposed to be included in COR:					
Competences / **Descriptors**	Using knowledge from the fundamental disciplines of engineering in conducting calculations, demonstrations and applications, to solve engineering tasks: Applicant of fundamental knowledge in engineering.	Selection, combining and use of knowledge, principles and methods in the field of system engineering and aerospace engineering through functional schemes and graphical representations to solve domain specific tasks: user of engineering graphics, functional schemes and system engineering methods.	Use of programming languages and environments, software applications and information technology to solve specific tasks for aerospace engineering: user of specific software applications.	Modelling and analysis of aircraft flight dynamics, command and stabilization systems and flight management systems design: Dynamic and Flight Control Engineer.	Using and evaluating the performance of aircraft, radar, navigation and guidance equipment, aircraft power and hydro-pneumatic equipment; avionics specialist and aircraft operator systems.	Maintenance and repair of aircraft, radar, navigational and guidance equipment, electro-energetic and hydro-pneumatic drive equipment for aircraft: specialist in maintenance and repairs of avionics equipment and aircraft operator systems.
KNOWLEDGE						
1. Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area;	Appropriate identification of basic principles, theorems and basic methods in mathematics, technical drawing and programming of computers, physical and	Defining the principles and methods in the basic sciences of aerospace engineering associated with graphic representations-technical	Identification of the solver model according to the target application, methods of different approximation levels in the field of numerical computing	Identification of the concepts, theories, methods and basic principles of system mechanics and theory, dynamics and stability of automated flight.	Description of basic concepts, theories, methods and principles in the field of electrical measurements, the operation of avionics	Description of basic concepts, theories, methods and principles for inspection, maintenance, operation and diagnosis of avionics, navigation, automation, electro-energetics and aircraft systems.

	theoretical models in physics, chemistry and mechanics of continuous environments, as well as their proper use in professional communication.	drawing, computational graphics, functional schemes.	specific to aviation equipment and installations and appropriate processing for professional communication.		equipment and aircraft operating systems.	
2 Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	Use basic knowledge of fundamental disciplines to explain and interpret the theoretical results in relation to experimental theories, phenomena or processes specific to the field of aerospace engineering.	Using knowledge from basic engineering sciences to explain and interpret the theoretical and / or experimental results, the airplane as a system, phenomena or processes, general and aerospace engineering detail drawings.	Using the basic knowledge associated with software and digital technologies to explain and interpret demonstrations, numerical computations dedicated to aerospace engineering, assisted graphics, and explanation and interpretation of situations by reference to experimental results or type problems.	Use of basic knowledge to explain and interpret the different types of flight regimes and evolutions of automatic flight instruments made by methods and procedures specific to the directional flight dynamics.	Using basic knowledge to explain and interpret the operation of different types of board, computers and onboard integrated systems, air navigation systems, power and drive systems. Understanding the certification methodology in the aerospace industry.	Use the basic knowledge to explain and interpret the issues that arise in the inspection and operation of avionics, navigation, automation, electro-energetics and drive systems, as well as to ensure their quality.
SKILLS						
3. Application of advanced principles and methods to solve complex and unpredictable problems/situations that are typical to the field of work /study.	Applying basic theorems, principles and methods of basic disciplines for basic calculations in the design and operation of technical systems, specific to aerospace engineering, in conditions of qualified assistance	Applying basic theorems, principles and methods of basic disciplines for basic calculations in the design and operation of technical systems, specific to aerospace engineering, in conditions of qualified assistance	Application of basic principles and methods of software and digital technologies for programming, database development, assisted graphics, modelling, computer-aided design of configurations and structures, computer-aided investigation and computerization of data specific to aerospace engineering, and aviation equipment and installations	Apply basic principles and methods for processing and displaying data for designing the command system in accordance with aerospace specifications and standards.	Apply basic principles and methods for designing on-board integrated and drive systems in line with current industry standards.	Apply basic principles and methods for quality assurance and inspection of avionics, navigation, automation, electro-energetic equipment and aircraft operating systems under qualified assistance.

			in particular under the conditions of qualified assistance.			
4 Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	Appropriate use of standard criteria and methods of assessment, from fundamental disciplines, for qualitative and quantitative identification, modelling, analysis and qualitative and quantitative assessment of specific phenomena and parameters, as well as for the processing and interpretation of results, from processes specific to aerospace engineering.	Appropriate use of standard criteria and methods of assessment in basic engineering sciences for the identification, modelling, experimentation, analysis and qualitative and quantitative assessment of defining aspects, phenomena and parameters, as well as for the collection of data and the processing and interpretation of the results, from processes specific to aerospace engineering	Appropriate use of standard assessment criteria and methods to assess the quality, efficiency and accuracy of software program results for performing tasks specific to aerospace engineering in general and aviation equipment and installations in particular.	Appropriate use of criteria and standard assessment methods to assess the quality, benefits and limitations of the usual automatic flight control systems.	Appropriate use of criteria and standard methods for assessing the performance of electrical, electronic, electromechanical, fluid equipment, electrical equipment and power systems and aircraft actuators.	Appropriate use of standard assessment criteria and methods to assess the quality, advantages and limitations of the quality assurance, inspection and diagnosis methods of aircraft equipment and aircraft operating systems.
5. Development of professional and/or research projects using well known principles, methods and software within the field	Developing models and professional projects specific to aerospace engineering based on the identification, selection and use of principles, optimal methods and established solutions from the fundamental disciplines.	Developing professional projects specific to aerospace engineering based on selecting, combining and using the knowledge, principles and methods of the basic sciences of aerospace engineering and their association with integrated system representations, graphic design and functional schemes.	Developing professional projects specific to aerospace engineering in general and aviation equipment and installations, in particular on the basis of the selection, combination and use of principles, methods, digital technologies, computer systems and software tools established and compliant with aerospace regulations .	Elaboration of professional projects of dynamics and stability of the flight conducted by specific methods and procedures.	Elaboration of professional projects for installation / maintenance / upgrading of onboard systems and actuation equipment using specific, well-established procedures, in the field of aerospace engineering.	Develop professional projects using the established principles and methods of quality assurance, product inspection and diagnostics of avionics equipment and aircraft operating systems.
6. Communication in different contexts / environments, including foreign	Standard: Optimal computational solving and complex problems related to the core engineering	Standard: Optimal solution of complex problems requiring the corroboration of knowledge in the	Standard: optimal solution of engineering problems, database management, experimental data	Standard: modelling of aircraft dynamics to standard flight conditions, analysis of manoeuvrability performance;	Standard: designing a system for measuring, processing and displaying on-board information and	Standard: Optimal resolution of issues relating to quality assurance and diagnosis of avionics equipment and aircraft operating systems.

languages and ICT-mediated, communication adapted to various public	disciplines in the field of aerospace engineering tasks Minimum level: Correct solving of mathematical and physical complexity and physical complexity problems, specific to aerospace engineering.	technical sciences of the aerospace field with graphic representations - technical drawing. Minimum level: Correct solving of medium complexity problems in the field of aerospace engineering, correct recognition and choice of materials for aeronautical applications, as well as correct reading, interpretation and representation of functional schemes, technical drawings of medium complexity, including specifying technical conditions and the association between the prescribed characteristics and the functional role of the subsystems.	processing and 2D and 3D modelling, predominantly in the field of aviation equipment and installations. Minimum level: Correct solving of engineering problems, medium complexity, programming, database management, experimental data processing and 2D and 3D modelling, mainly in the field of aviation equipment and installations.	designing the automatic control system and analysing its performance. Minimum level: Determination of an aircraft dynamics model at fixed flight conditions, conventional design, simulation and performance analysis of a flight control system based on current specifications.	designing the aircraft command system. Minimum level: designing a system of measurement and processing of flight information / navigation of medium complexity; designing an average complex electrical power plant; evaluating performance in terms of data and imposed methods.	Minimum level: Correct solving of average complexity problems related to quality assurance and diagnosis of avionics equipment and aircraft drive systems.
AUTONOMY AND RESPONSABILITY						
7. Supervision and assistance in managing complex technical or professional activities or projects	Execution of professional tasks under conditions of limited autonomy and qualified assistance, based on documentation, convergent and divergent logical reasoning, practical applicability, evaluation, self-evaluation and optimal decision.					
8. Take responsibility for decision-making in predictable, unpredictable work or study context	Responsible execution of professional tasks, with respect to the values and ethics of the engineer profession, based on documentation, convergent and divergent logical reasoning, practical applicability, evaluation, self-evaluation and optimal decision: executor responsible for professional tasks.					

SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.	Achieving specific activities and roles for teamwork on different responsibilities and distributing tasks for subordinate levels, based on communication and dialogue, co-operation, pro-active attitude and respect for others: communication skills and teamwork.					
10. Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.	Objective self-evaluation of the need for professional development and openness to lifelong learning as well as effective use of language skills, knowledge of information and communication technology for personal and professional development: aware of the need for continuous training.					
Minimum performance standards for integrated learning outcomes assessment:	Standard: Achieving and sustaining the quality of the year projects and the bachelor project.	Minimum level: Performing year projects and homework of medium complexity and the bachelor project, with the correct use of bibliographic sources, norms, standards and specific methods, under conditions of limited autonomy and qualified assistance, as well as supporting them with the demonstration the capacity of qualitative and quantitative evaluation of technical solutions in the field and of its own results.	Standard: group work of projects or projects with the identification and description of professional roles at the team level.	Minimum level: performing group projects or projects of medium complexity with the proper identification and description of the professional roles at the team level and respecting the main attributes of team work.	Standard: Identification of the need for professional training, critical analysis of training and professional development, and efficient use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.).), including using foreign languages, participation in internal and international student and student internship sessions and internships, internships for the internship period.	Minimum level: Identify the need for professional training with a satisfactory analysis of their own training and professional development and the appropriate use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.). .), including using at least one foreign language.

9.3.2.3 Description for Study Programme Engineering and Aeronautic Management

Study Field ENGINEERING SCIENCES **Study Programme** **ENGINEERING AND AERONAUTIC MANAGEMENT**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title **Engineering and Aeronautic Management** Qualification Level: **6 - BACHELOR**	Existing and possible occupations: ● Possible occupations according to COR: 123509 - Sale Relationship Manager; 241919 - Project Manager; 241938 - Product Manager; 1232 - Supply and sales manager; 1233 - Leader in sales and marketing activity; 1235 - Leader in personnel services, staff training and other working relationships; 1237 - Business manager, intermediaries and other commercial services; 1311 - Manager in the wholesale and retail trade; 214533 - Mechanical Engineer Advisor; 214548 - Engineer for the protection of air navigation (communications, navigation, surveillance); 214506 - Aircraft Engineer; 214537 - Aircraft Engineer Designer; 214538 - Mechanical engineer designer; 214512 - Gymnasium Teacher (provided that 30 points are accumulated in the psycho-pedagogical module); 244109 - Economist engineer; ● New employees proposed to be included in COR: Sales Engineer.					
COMPETENCES **DESCRIPTORS**	Using knowledge from the fundamental disciplines of engineering in conducting calculations, demonstrations and applications, to solve engineering tasks: Applicant of fundamental knowledge in engineering.	Selection, combining and use of knowledge, principles and methods in the field of system engineering and aerospace engineering through functional schemes and graphical representations to solve domain specific tasks: user of engineering graphics, functional schemes and system engineering methods.	Use of programming languages, software applications and information technology to solve specific tasks for aerospace engineering: user of specific software applications.	Planning, organizing and controlling aeronautical agent-specific processes and systems with air-to-air capability assessment in a regional and global context: planning, organizing and managing aeronautical agent-specific processes.	Implementation of international, Community and national aeronautical regulations for carrying out activities in specific processes with assessment of economic and social impact on stakeholders: Designer of specific aeronautical procedures.	Managing and optimizing processes at the aeronautical level, ensuring a level of safety, security, quality and environment, according to specific rules: procedures integrator in relation to international, community and national safety, security, quality and environment regulations in the field.
KNOWLEDGE						
1. Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area;	Appropriate identification of basic principles, theorems and basic methods in mathematics, technical drawing and programming of computers, physical and theoretical models in physics, chemistry and	Defining the principles and methods in the basic sciences of aerospace engineering associated with graphic representations-technical drawing, computational	Identification of the solver models according to the target application, methods of different approximation levels in the field of numerical computing specific to the engineering and aeronautical	Identification of concepts, theories, basic methods and principles, technical-economic assessment, planning, programming, coordination and control of production systems or services.	Description of concepts, theories, methods, rules and basic principles of aeronautical design.	The description, theories, methods and basic principles of process planning that are carried out at the level of a regulated agent system.

	mechanics of continuous environments, as well as their proper use in professional communication.	graphics, functional schemes.	management and appropriate processing for the professional communication.			
2 Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	Use basic knowledge of fundamental disciplines to explain and interpret the theoretical results in relation to experimental theories, phenomena or processes specific to the field of aerospace engineering.	Using knowledge from basic engineering sciences to explain and interpret the theoretical and / or experimental results, the airplane as a system, phenomena or processes, general and aerospace engineering detail drawings.	Using the basic knowledge associated with software and digital technologies to explain and interpret demonstrations, numerical computations dedicated to aerospace engineering, assisted graphics, as well as explaining and interpreting situations by referring to experimental results or type problems.	Use basic knowledge to explain and interpret the methods of evaluation, monitoring, analysis and control of planned, scheduled and random activities in the process of conducting production or service provision in the aeronautical system.	Use basic knowledge to explain and interpret procedures that occur in the design of aeronautical agent activities.	Use basic knowledge to explain and interpret the various types of managerial decisions in the activities of aeronautical agents, in relation to the procedures established in the field and on the basis of performance indicators.
SKILLS						
3. Application of advanced principles and methods to solve complex and unpredictable problems/situations that are typical to the field of work /study.	Applying basic theorems, principles and methods of basic disciplines for basic calculations in the design and operation of technical systems, specific to aerospace engineering, in conditions of qualified assistance	Applying basic theorems, principles and methods of basic disciplines for basic calculations in the design and operation of technical systems, specific to aerospace engineering, in conditions of qualified assistance	Application of basic principles and methods of software and digital technologies for programming, database development, assisted graphics, modelling, computer-aided design of configurations and structures, computer-aided investigation and computerization of data specific to aerospace engineering, and aeronautical engineering and management in particular, under qualified assistance.	Applying procedures and methods for technical and economic assessment, planning, coordination and control of production systems and services under qualified assistance.	Application of certified procedures and methods in accordance with the regulations for the design of processes carried out within the aeronautical agents and for ensuring their safety and quality under the conditions of qualified assistance.	Apply procedures and methods in accordance with aeronautical regulations for managing activities under qualified assistance. Appropriate use of procedures and regulations for the assessment of activities in accordance with the rules established by the competent authority to assess the quality or degree of compliance of programs carried out in aviation establishments.

4 Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	Appropriate use of standard criteria and methods of assessment, from fundamental disciplines, for qualitative and quantitative identification, modelling, analysis and qualitative and quantitative assessment of specific phenomena and parameters, as well as for the processing and interpretation of results, from processes specific to aerospace engineering.	Appropriate use of standard criteria and methods of assessment in basic engineering sciences for the identification, modelling, experimentation, analysis and qualitative and quantitative assessment of defining aspects, phenomena and parameters, as well as for the collection of data and the processing and interpretation of the results, from processes specific to aerospace engineering	Appropriate use of standard criteria and assessment methods to assess the quality, efficiency and accuracy of software program results for achieving tasks specific to aerospace engineering in general and specifically aeronautical engineering and management.	Appropriate use of procedures to develop a quality system that responds to the needs and conditions imposed by the competent authority and continuously assesses the specific activities performed within the aeronautical agents.	Appropriate use of standard evaluation criteria and methods to assess the quality of the design processes and the application of methods to optimize the activities carried out in safety, quality and environmental protection in accordance with established rules.	
5. Development of professional and/or research projects using well known principles, methods and software within the field	Developing models and professional projects specific to aerospace engineering based on the identification, selection and use of principles, optimal methods and established solutions from the fundamental disciplines.	Developing professional projects specific to aerospace engineering based on selecting, combining and using the knowledge, principles and methods of the basic sciences of aerospace engineering and their association with integrated system representations, graphic design and functional schemes.	Developing professional projects specific to aerospace engineering based on selecting, combining and using the knowledge, principles and methods of the basic sciences of aerospace engineering and their association with integrated system representations, graphic design and functional schemes	Elaboration of projects on the evaluation, planning, programming and management of the aero-economic agents' technical and economic processes.	Develop strategic projects or processes related to managerial activities that integrate all aeronautical agents involved.	Develop procedures in line with applicable aeronautical legislation, using the established principles and methods in the field, to highlight the degree of compliance of the activities carried out.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication	Standard: Optimal computational solving and complex problems related to the core engineering disciplines in the field of aerospace engineering tasks	Standard: Optimal solution of complex problems requiring the corroboration of knowledge in the technical sciences of the aerospace field with	Standard: Optimal solution of engineering problems, database management, experimental data processing and 2D and 3D modelling, predominantly in	Standard: Defining all the components of the analysed process, the degree of integration at the local and global level from a technical, economic and managerial point of view.	Standard: Develop a project to assess the available data capacities of an airport, airline or production system to plan, organize and coordinate scheduled	Standard: Optimal resolution of problems in designing processes, as well as ensuring the safety and quality of the activities or products obtained. Minimum level:

adapted to various public	Minimum level: Correct solving of mathematical and physical complexity and physical complexity problems, specific to aerospace engineering.	graphic representations - technical drawing. Minimum level: Correct solving of medium complexity problems in the field of aerospace engineering, correct recognition and choice of materials for aeronautical applications, as well as correct reading, interpretation and representation of functional schemes, technical drawings of medium complexity, including specifying technical conditions and the association between the prescribed characteristics and the functional role of the subsystems.	the field of aeronautical engineering and management. Minimum level: Correct solving of engineering problems, medium complexity, programming, database management, experimental data processing and 2D and 3D modelling, mainly in the field of aeronautical engineering and management.	Minimum level: Defining some basic components of the analysed process in relation to certain given input conditions and establishing the integration and settlement ratio in relation to some factors of influence.	activities based on system and process-based technical and economic assessments. Minimum level: Develop a project in accordance with ICAO, EASA, or JAA rules to manage certain resources and assess their impact on all stakeholders.	Correct solving of average complexity problems related to the design of processes, as well as to ensuring the safety and quality imposed on the activities or products obtained.
AUTONOMY AND RESPONSABILITY						
7. Supervision and assistance in managing complex technical or professional activities or projects	Execution of professional tasks under conditions of limited autonomy and qualified assistance, based on documentation, convergent and divergent logical reasoning, practical applicability, evaluation, self-evaluation and optimal decision.					
8. Take responsibility for decision-making in predictable, unpredictable work or study context	Responsible execution of professional tasks, with respect to the values and ethics of the engineer profession, based on documentation, convergent and divergent logical reasoning, practical applicability, evaluation, self-evaluation and optimal decision: executor responsible for professional tasks.					

SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.	Achieving specific activities and roles for teamwork on different responsibilities and distributing tasks for subordinate levels, based on communication and dialogue, co-operation, pro-active attitude and respect for others: communication skills and teamwork.					
10. Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.	Objective self-evaluation of the need for professional development and openness to lifelong learning as well as effective use of language skills, knowledge of information and communication technology for personal and professional development: aware of the need for continuous training.					
Minimum performance standards for integrated learning outcomes assessment:	Standard: Achieving and sustaining the quality of the year projects and the bachelor project.	Minimum level: Performing year projects and homework of medium complexity and the bachelor project, with the correct use of bibliographic sources, norms, standards and specific methods, under conditions of limited autonomy and qualified assistance, as well as supporting them with the demonstration the capacity of qualitative and quantitative evaluation of technical solutions in the field and of its own results.	Standard: group work of projects or projects with the identification and description of professional roles at the team level.	Minimum level: performing group projects or projects of medium complexity with the proper identification and description of the professional roles at the team level and respecting the main attributes of team work.	Standard: Identification of the need for professional training, critical analysis of training and professional development, and efficient use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.).), including using foreign languages, participation in internal and international student and student internship sessions and internships, internships for the internship period.	Minimum level: Identify the need for professional training with a satisfactory analysis of their own training and professional development and the appropriate use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.). .), including using at least one foreign language.

9.3.2.4 Description for Study Programme Aircraft and aviation engines

Study Field ENGINEERING SCIENCES **Study Programme AIRCRAFT AND AVIATION ENGINES**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title **Aircraft and aviation engines** Qualification Level: **6 - BACHELOR**	Existing and possible occupations: Possible occupations: 214506 aviation engineer; 251502 aircraft research engineer; 251505 aerospace construction engineer; 214417 Aircraft Reception and Control Engineer; 214405 navigation engineer; 214434 aeronautical inspector; 214537 engineer aircraft designer; 214538 mechanical engineer designer; 251506 aerospace research assistant; 251512 research assistant on board equipment and installations; 242313 standardization assistant; 214533 mechanical engineer advisor; 114225 counsellor president national professional organization; 111070 Presidential adviser; 214439 technical adviser; 731123 Compliance controller in the automotive industry; 123713 project director; 121023 branch and assistant director; 214534 mechanical engineer; 214535 mechanical engineer inspector; 232201 teacher in gymnasium education (provided the accumulation of 30 credit points in pedagogical training); 214536 specialist engineer mechanic; 214544 Mechanical Maintenance Specialist Industrial Equipment, 122646 - Head of Service, Center, Station, Airport and Assimilated.					
COMPETENCES / **DESCRIPTORS**	Using knowledge from the fundamental disciplines of engineering in conducting calculations, demonstrations and applications, to solve engineering tasks: Applicant of fundamental knowledge in engineering.	Selection, combining and use of knowledge, principles and methods in the field of system engineering and aerospace engineering through functional schemes and graphical representations to solve domain specific tasks: user of engineering graphics, functional schemes and system engineering methods.	Use of programming languages and environments, software applications and information technology to solve specific tasks for aerospace engineering: user of specific software applications.	Assessment of flight performance of military and civil aircraft, thermo-gaso-dynamic processes specific to aviation propulsion systems, command-control equipment, design of functional schemes and overall aircraft and engine performance assessment: aerodynamic specialist, flight dynamics, aeronautical propulsion systems , aviation equipment and installations.	Design and development of technical specifications, acquisition, operation and diagnostics of equipment, aviation installations, components in the functional scheme of propulsion systems, on-board and rescue, communication and command-control systems: designer for components, subassemblies and installations.	Planning, organizing, coordinating and controlling technical and logistics activities, manufacturing, operation, and maintenance, quality assurance, and acquisition of aviation engineering equipment and systems: technological and managerial skills.
KNOWLEDGE						
1. Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area;	Appropriate identification of basic principles, theorems and basic methods in mathematics, technical drawing and programming of computers, physical and	Defining the principles and methods in the basic sciences of aerospace engineering associated with graphic representations-technical	Identification of the solver model according to the target application, methods of different approximation levels in the field of numerical computing	Identification of the basic techniques, methods and tools of designing, manufacturing, testing for aerodynamics, flight dynamics and stability in the	Description of the needs of the national defence system, public order and national security and the concept of using the	Appropriate description of the principles of organization and operation of the technical and logistic structures specific to the national defence and security system.

	theoretical models in physics, chemistry and mechanics of continuous environments, as well as their proper use in professional communication.	drawing, computational graphics, functional schemes.	specific to civil and military aircraft and aviation engines and appropriate processing for professional communication.	operation of aerospace propulsion systems.	technique specific to aviation technical systems.	
2 Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	Use basic knowledge of fundamental disciplines to explain and interpret the theoretical results in relation to experimental theories, phenomena or processes specific to the field of aerospace engineering.	Using knowledge from basic engineering sciences to explain and interpret the theoretical and / or experimental results, the airplane as a system, phenomena or processes, general and aerospace engineering detail drawings.	Using the basic knowledge associated with software and digital technologies to explain and interpret demonstrations, numerical computations dedicated to aerospace engineering, assisted graphics, and explanation and interpretation of situations by reference to experimental results or type problems.	Explaining and interpreting technical and technological solutions for aircraft aerodynamics and flight dynamics, thermo-gazo-dynamic processes, automotive propulsion systems.	Using basic knowledge to explain and interpret the planning, organization, management, control, coordination, use and maintenance of aviation technique throughout the lifecycle, interpreting various structural and operational concepts.	Use of basic knowledge to explain and interpret problems arising in logistics support for aviation technique used for the needs of the national defence, public order and national security system.
SKILLS						
3. Application of advanced principles and methods to solve complex and unpredictable problems/situations that are typical to the field of work /study.	Applying basic theorems, principles and methods of basic disciplines for basic calculations in the design and operation of technical systems, specific to aerospace engineering, in conditions of qualified assistance	Applying basic theorems, principles and methods of basic disciplines for basic calculations in the design and operation of technical systems, specific to aerospace engineering, in conditions of qualified assistance	Application of basic principles and methods of software and digital technologies for programming, database development, assisted graphics, modelling, computer-aided design of configurations and structures, computer-aided investigation and computerization of data specific to aerospace engineering, and civilian and military aircraft and	Solving complex problems of designing aerodynamic configurations, assessing flight performance and stability, thermo-gaso-dynamic processes in aerospace propulsion systems, command and control schemes and demonstrating the results of its own assessment using appropriate techniques	Elaboration of technical specifications, acquisition and operation of aviation technology, application of procedures for design and calculation of aerospace structures and subassemblies in aerospace propulsion systems.	Applying modern management principles for organizing logistics support activities for aviation engineering.

			aviation engines in particular under the conditions of qualified assistance.			
4 Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	Appropriate use of standard criteria and methods of assessment, from fundamental disciplines, for qualitative and quantitative identification, modelling, analysis and qualitative and quantitative assessment of specific phenomena and parameters, as well as for the processing and interpretation of results, from processes specific to aerospace engineering.	Appropriate use of standard criteria and methods of assessment in basic engineering sciences for the identification, modelling, experimentation, analysis and qualitative and quantitative assessment of defining aspects, phenomena and parameters, as well as for the collection of data and the processing and interpretation of the results, from processes specific to aerospace engineering	Appropriate use of standard assessment criteria and methods to assess the quality, efficiency and accuracy of software program results for the accomplishment of tasks specific to aerospace engineering in general and civilian and military aircraft and aviation engines in particular.	Appropriate use of standard criteria and methods for the qualitative and quantitative assessment of aerospace configurations, thermo-gazo-dynamic phenomena in aerospace propulsion systems and the ability to support and demonstrate the optimal solutions chosen in the given technical-economic context.	Use of appropriate performance criteria to assess the quality and state of the art of aviation engineering; application of the principles of aviation technical insurance.	Appropriate use of standard criteria and assessment methods to assess the quality, advantages and limitations of technical and logistics structures, the organization of logistical support, quality assurance, management of the financial funds necessary to carry out research and procurement projects aviation equipment and systems.
5. Development of professional and/or research projects using well known principles, methods and software within the field	Developing models and professional projects specific to aerospace engineering based on the identification, selection and use of principles, optimal methods and established solutions from the fundamental disciplines.	Developing professional projects specific to aerospace engineering based on selecting, combining and using the knowledge, principles and methods of the basic sciences of aerospace engineering and their association with integrated system representations, graphic design and functional schemes.	Developing professional projects specific to aerospace engineering in general and civilian and military aircraft and aviation engines, in particular, based on the selection, combination and use of principles, methods, digital technologies, computer systems and software tools established and compliant with the aerospace domain.	Concept, design, realization, testing of aviation structures and engines, improvement and modernization of the existing ones, in accordance with the achievements of science and technology, as well as with the requirements formulated, the application of standard criteria and methods for the appreciation of the advantages and limitations of a calculation method.	Elaboration of projects for the calculation and construction of aeronautical structures and aerospace systems, formulation of solutions by endowing the national defence system, public order and national security with aviation technique; planning, organizing, executing and controlling the maintenance of aviation technology.	Elaboration of professional projects regarding the dimensioning, organization and management of technical and logistic structures, coordination of logistic support activities.
6. Communication in different contexts /	Standard: Optimal computational solving and	Standard: Optimal solution of complex problems	Standard: optimal engineering problem	Standard: Develop a project in accordance with standards	Standard: Elaboration of a project in accordance with	Standard: Optimal resolution of problems specific to

environments, including foreign languages and ICT-mediated, communication adapted to various public	complex problems related to the core engineering disciplines in the field of aerospace engineering tasks Minimum level: Correct solving of mathematical and physical complexity and physical complexity problems, specific to aerospace engineering.	requiring the corroboration of knowledge in the technical sciences of the aerospace field with graphic representations - technical drawing. Minimum level: Correct solving of medium complexity problems in the field of aerospace engineering, correct recognition and choice of materials for aeronautical applications, as well as correct reading, interpretation and representation of functional schemes, technical drawings of medium complexity, including specifying technical conditions and the association between the prescribed characteristics and the functional role of the subsystems.	solving, database management, experimental data processing and 2D and 3D modelling, mainly in civil and military aircraft and aviation engines. Minimum level: Correct solving of engineering problems, medium complexity, programming, database management, experimental data processing and 2D and 3D modelling, mainly in the field of civil and military aircraft and aviation engines.	approved by the guardianship authority to configure a military aircraft equipped with weapon systems. Minimum level: Elaboration of a medium complexity project in accordance with standards approved by the guardianship authority to configure a military aircraft equipped with weapon systems under required data conditions	the rules approved by the guardianship authority on the dimensioning of the basic components of a military aircraft equipped with a specific propulsion system and aviation weapon systems Minimum level: Elaboration of a medium complexity project in accordance with the rules approved by the guardianship authority regarding the dimensioning of the basic components of a military aircraft equipped with a specific propulsion system and aviation weapon systems under imposed data conditions	manufacturing, operation, repair, maintenance and use in combat. Minimum level: Correct solving of average complexity problems specific to manufacturing, exploitation, repair, maintenance and use in combat.
AUTONOMY AND RESPONSABILITY						
7. Supervision and assistance in managing complex technical or professional activities or projects	Execution of professional tasks under conditions of limited autonomy and qualified assistance, based on documentation, convergent and divergent logical reasoning, practical applicability, evaluation, self-evaluation and optimal decision.					

8. Take responsibility for decision-making in predictable, unpredictable work or study context	Responsible execution of professional tasks, with respect to the values and ethics of the engineer profession, based on documentation, convergent and divergent logical reasoning, practical applicability, evaluation, self-evaluation and optimal decision: executor responsible for professional tasks.					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.	Achieving specific activities and roles for teamwork on different responsibilities and distributing tasks for subordinate levels, based on communication and dialogue, co-operation, pro-active attitude and respect for others: communication skills and teamwork.					
10. Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.	Objective self-evaluation of the need for professional development and openness to lifelong learning as well as effective use of language skills, knowledge of information and communication technology for personal and professional development: aware of the need for continuous training.					
Minimum performance standards for integrated learning outcomes assessment:	Standard: Achieving and sustaining the quality of the year projects and the bachelor project.	Minimum level: Performing year projects and homework of medium complexity and the bachelor project, with the correct use of bibliographic sources, norms, standards and specific methods, under conditions of limited autonomy and qualified assistance, as well as supporting them with the demonstration the capacity of qualitative and quantitative evaluation of technical solutions in the field and of its own results.	Standard: group work of projects or projects with the identification and description of professional roles at the team level.	Minimum level: performing group projects or projects of medium complexity with the proper identification and description of the professional roles at the team level and respecting the main attributes of team work.	Standard: Identification of the need for professional training, critical analysis of training and professional development, and efficient use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.). including using foreign languages, participation in internal and international student and student internship sessions and internships, internships for the internship period.	Minimum level: Identify the need for professional training with a satisfactory analysis of their own training and professional development and the appropriate use of communication and training resources (Internet, e-mail, databases, on-line courses, etc.).including using at least one foreign language.

9.3.3 Description of Qualifications for Aeronautics

9.3.3.1 Description for Study Programme Air Traffic Controller

Study Field *AERONAUTICS* **Study Programme UNDERGRADUATE UNIVERSITY STUDY PROGRAME OF AERONAUTICS – AIR TRAFFIC CONTRLLER**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title: air traffic controller Qualification Level: **6 - BACHELOR**	Existing and possible occupations: • Possible occupations: air traffic instructor, air traffic safety technician, air traffic controller, airspace manager					
COMPETENCES / **DESCRIPTORS**	Know the principles and have the fundamental knowledge in the field of natural sciences and engineering	Analyse the situation, identify and define a simple problem in the field of aeronautics, and provide a solution using available methods and technologies	Apply prescribed standard operating procedures and methods in aircraft navigation and guidance	Successfully communicate with experts in the field of aeronautics and air traffic management using adequate technology and appropriate terminology in speaking and writing	Solve less complex technical and technological problems	Be able to work independently and in a team, and present the results of work in accordance with professional ethics, standards and best practices in aviation
KNOWLEDGE						
1. Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area;	Explain air traffic control theory in the context of the principles of flight	Identify and use fundamental terminology on rules of the air and air traffic control services	Plan aircraft operations based on data obtained from Flight Information Services	Use radiotelephony phraseology in all stages of flight	Compare available aircraft flight performance data with those needed for specific phases of flight	Explain the relationship between capacity and air traffic demand in air traffic management
2 Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	Analyse the influence of forces of flight on aircraft movement in uniform and non-uniform regime	Explain the principles and types of air traffic control services and explain the elements of coordination in air traffic control	Identify and use terminology related to Flight Information Services and be familiar with the procedure for announcing and publishing information in aviation	Harmonise and use radiotelephony phraseology to issue information, instructions and clearances for arriving and departing traffic	Be familiar with and apply legal provisions on the air traffic management	Compare procedures related to air traffic control services, air traffic management and airspace management, and air traffic flow management

SKILLS						
3. Application of advanced principles and methods to solve complex and unpredictable problems/situations that are typical to the field of work /study.	Apply operating principles of aircraft systems in navigation, communication and aircraft traffic management	Provide air traffic control and separation minima in the controlled zone and issue clearances and information to aircraft	Define elements to determine optimal location of airports according to meteorological, navigation, topographical, traffic, urban and environmental conditions	Apply actions and procedures on aircraft during vectoring until reaching final approach	Define regulations and prescribe requirements and limitations for different aircraft categories (A, B and C)	Apply methods for defining air traffic complexity regarding air traffic controllers workload and airspace characteristics
4 Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	Use methods for determining and measuring the elements needed for assessing aircraft flight performance	Use radar vectoring to control the flight taking into account separation norms and air traffic flow parameters	Identify ICAO standards and recommended practices regarding arrival and departure of aircraft and entry and exit of persons and goods	Use radiotelephony phraseology for standard and non-standard arrivals and departures	Use appropriate VFR and IFR navigation charts in defining elements necessary for flight preparation as well as meteorological maps and flight information	Assess the importance of monitoring of air traffic control services in the context of air traffic sustainability
5. Development of professional and/or research projects using well known principles, methods and software within the field	Analyse a pre-defined problem and propose a log frame	Act according to the standard procedures in the event of loss of separation	Analyse the conditions on airport surfaces in accordance to the appropriate methodology, prescribed legislation, day and night signs and markings and obstacle markings	Plan a flight in radar environment and simulate the most important situations using radiotelephony phraseology	Apply safety rules and measures using appropriate technical standards	Use appropriate programmes for analysis and simulation in defined environment (NEST)
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Make calculations and present results in accordance with engineering practice	Update flight strips according to the air traffic situation	Identify technical and technological characteristics of communication and surveillance systems in air traffic control	Interpret and use aeronautical information correctly	Apply appropriate actions and procedures related to air traffic safety	Explain objectives and solutions in relation the phases of the Single European Sky implementation and the importance of research and development
AUTONOMY AND RESPONSABILITY						

7. Supervision and assistance in managing complex technical or professional activities or projects	Act independently in aeronautical field, carry out activities, maintain continuity in fulfilling tasks and reaching the ultimate goal at the level of acquired knowledge and competences					
8. Take responsibility for decision-making in predictable, unpredictable work or study context	Critically and self-critically evaluate arguments, assumptions, abstract concepts and data in order to make decisions					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.	Work effectively in teams and adjust to the demands of working environment					
10. Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.	Understand the impact of engineering on society and the environment, and show a highly moral and ethical approach in solving engineering problems and adapt to changes in technology and methods of work in the context of lifelong learning					
Minimum performance standards for integrated learning outcomes assessment:	Apply knowledge and understanding of aircraft flight performance trough devising and sustaining arguments.	Communicate information, ideas, problems and solutions of air traffic control procedures and practice.	Apply knowledge and understanding of prescribed standard operating procedures and methods in aircraft navigation and guidance	Interpret relevant data in the field of aeronautics and air traffic management	Have developed those learning skills that are necessary to continue to undertake further study with the high degree of autonomy in solving less complex technical and technological problems	Demonstrate ability to work in medium complex projects with the proper identification and description of the professional roles at the team level and respecting the main attributes of team work

9.3.3.2 Description for Study Programme Civil Pilot

Study Field *AERONAUTICS* **Study Programme UNDERGRADUATE UNIVERSITY STUDY PROGRAME OF AERONAUTICS – CIVIL PILOT**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title: civil pilot Qualification Level: **6 - BACHELOR**	Existing and possible occupations: • Possible occupations airline pilot, pilot of commercial aircraft, pilot of commercial aeroplanes, dispatcher					
COMPETENCES **DESCRIPTORS**	Know the principles and have the fundamental knowledge in the field of natural sciences and engineering	Analyse the situation, identify and define a simple problem in the field of aeronautics, and provide a solution using available methods and technologies	Apply prescribed standard operating procedures and methods in aircraft navigation and guidance	Successfully communicate with experts in the field of aeronautics and air traffic management using adequate technology and appropriate terminology in speaking and writing	Solve less complex technical and technological traffic problems	Be able to work independently and in a team, and present the results of work in accordance with professional ethics, standards and best practices in aviation
KNOWLEDGE						
1. Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area;	Identify and define fundamental units in aerodynamics and calculate aerodynamic forces for different regimes of flight	Identify fundamental principles of air transport systems and processes analysis	Create an optimal flight route	Use radiotelephony phraseology in all stages of flight	Explain similarities and differences of aircraft operating systems for different types of aircraft	Access risk factors and phenomena for aviation personnel
2 Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	Analyse the influence of forces of flight on aircraft movement in uniform and non-uniform regime of flight	Explain the concept of airspace and airspace usage in compliance with general and specific civil aviation regulations	Create a flight plan in accordance with the rules of the air and civil aviation regulations	Harmonise and use radiotelephony phraseology to issue information, instructions and clearances for arriving and departing traffic	Identify critical points of airframe structure and explain the impact of aircraft exploitation on material fatigue	Identify and define fundamental terminology on health issues in aviation
SKILLS						
3. Application of advanced principles and methods to solve complex and unpredictable	Apply operating principles of aircraft systems in	Apply rules of the air on an airspace in general and specific conditions	Apply theoretical knowledge of flight operations in air traffic	Apply actions and procedures on aircraft	Calculate performance of hydraulic system and landing gear of an aircraft	Determine variables of air traffic system (chemical, physiological, psychological, biological factors).

problems/situations that are typical to the field of work /study.	navigation, communication and aircraft traffic management			during vectoring until reaching final approach	(forces, kinetic energy, movements)	
4 Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	Use methods for determining and measuring the elements needed for assessing aircraft flight performance	Access the required elements and conditions for flight performance based on defined criteria and prescribed standards	Apply principles of dead reckoning and radio navigation in identifying navigation elements and in establishing the influence of wind on the flight path	Harmonize radiotelephony phraseology with navigation procedures for standard instrument arrival and departure (SID/STAR) and for holding procedure	Identify types of materials and their properties used in aviation and identify methods for aircraft element coupling	Identify and recognise factors that can severely compromise and endanger health of active and passive participants in air traffic
5. Development of professional and/or research projects using well known principles, methods and software within the field	Analyse a pre-defined problem and propose a log frame	Apply appropriate methods for analysis of airspace usage based on aircraft category	Analyse functional restrictions of the usage of specific navigation radio aids	Plan a flight in radar environment and simulate the most important situations using radiotelephony phraseology	Develop a simple procedure for aircraft inspection and maintenance based on the main elements of aircraft systems (hydraulic, fuel and cabin)	Define and identify psychological terms and phenomena that have an effect on a flight
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Make calculations and present results in accordance with engineering practice	Perform analysis and present results of simple problems in the field of aeronautics	Identify technical and technological characteristics of communication and surveillance systems in air traffic control	Explain important terminology prescribed by ICAO annexes	Explain the functioning of aircraft systems, draw and describe them	Explain the influence of chemical, physical and biological factors that influence flight safety
AUTONOMY AND RESPONSABILITY						
7. Supervision and assistance in managing complex technical or professional activities or projects	Act independently in aeronautical field, carry out activities, maintain continuity in fulfilling tasks and reaching the ultimate goal at the level of acquired knowledge and competences					
8. Take responsibility for decision-making in predictable,	Critically and self-critically evaluate arguments, assumptions, abstract concepts and data in order to make decisions					

unpredictable work or study context						
SOCIAL AND PERSONAL DEVELOPMENT						
9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.	Work effectively in teams and adjust to the demands of working environment					
10. Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.	Understand the impact of engineering on society and the environment, and show a highly moral and ethical approach in solving engineering problems and adapt to changes in technology and methods of work in the context of lifelong learning					
Minimum performance standards for integrated learning outcomes assessment:	Apply knowledge and understanding of aircraft flight performance trough devising and sustaining arguments.	Communicate information, ideas, problems and solutions of air transport systems and processes analysis	Apply knowledge and understanding of prescribed standard operating procedures and methods in aircraft navigation and guidance	Interpret relevant data in the field of aeronautics and air traffic management	Have developed those learning skills that are necessary to continue to undertake further study with the high degree of autonomy in solving less complex technical and technological problems	Demonstrate ability to work in medium complex projects with the proper identification and description of the professional roles at the team level and respecting the main attributes of team work

9.3.3.3. Description for Study Programme Military Pilot

Study Field *AERONAUTICS* **Study Programme UNDERGRADUATE UNIVERSITY STUDY PROGRAME OF AERONAUTICS – MILITARY PILOT**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title: military pilot Qualification Level: **6 - BACHELOR**	Existing and possible occupations: • Possible occupations air force pilot, air force officer, helicopter pilot, flight instructor					
COMPETENCES / **DESCRIPTORS**	Know the principles and have the fundamental knowledge in the field of natural sciences and engineering	Analyse the situation, identify and define a simple problem in the field of aeronautics, and provide a solution using available methods and technologies	Apply prescribed standard operating procedures and methods in aircraft navigation and guidance	Successfully communicate with experts in the field of aeronautics and air traffic management using adequate technology and appropriate terminology in speaking and writing	Solve less complex technical and technological traffic problems	Be able to work independently and in a team, and present the results of work in accordance with professional ethics, standards and best practices in aviation
KNOWLEDGE						
1. Knowledge and understanding of advanced concepts, theories and methods in the field and the specialization area;	Identify and define fundamental units in aerodynamics and calculate aerodynamic forces for different regimes of flight	Prepare a flight and determine performance in basic tactical flight manoeuvre	Apply basic principles for determining basic tactical flight manoeuvres of an aircraft	Use radiotelephony phraseology in all phases of flight	Explain similarities and differences of aircraft operating systems for different types of aircraft	Access risk factors and phenomena for aviation personnel
2 Use of advanced knowledge to explain and interpret various types of concepts, situations, processes, projects etc. related to the field	Analyse the influence of forces of flight on aircraft movement in uniform and non-uniform regime of flight	Explain the concept of air force and its operations in general and specific conditions in combat zones	Prepare a flight plan in the area of operations using tactical measures and procedures	Harmonise and use radiotelephony phraseology to issue information, instructions and clearances for arriving and departing traffic	Identify critical points of airframe structure and explain the impact of aircraft exploitation on material fatigue	Identify and define fundamental terminology on health issues in aviation and in accordance with the mission
SKILLS						

3. Application of advanced principles and methods to solve complex and unpredictable problems/situations that are typical to the field of work /study.	Apply operating principles of aircraft systems in navigation, communication and aircraft traffic management	Apply existing algorithms for search operations on area of operations	Apply theoretical knowledge to operate an aircraft in simple and complex combat operations	Apply actions and procedures on aircraft during vectoring until reaching final approach	Calculate performance of hydraulic system and landing gear of an aircraft (forces, kinetic energy, movements)	Determine variables of air traffic system (chemical, physiological, psychological, biological factors).
4 Adequate use of standard assessment criteria and methods to appraise the quality, merits and limitations of processes, programmes, projects, concepts, methods and theories	Use methods for determining and measuring the elements needed for assessing aircraft flight performance	Access the required elements and conditions for flight performance based on defined criteria and prescribed standards	Apply principles of dead reckoning and radio navigation in identifying navigation elements and in defining tactical scope of flight operations	Harmonize standard radiotelephony phraseology for navigation procedures with prescribed NATO phraseology regarding special combat missions	Identify types of materials and their properties used in aviation and identify methods for aircraft element coupling	Identify and recognise factors that can severely compromise and endanger the positive outcome of the mission
5. Development of professional and/or research projects using well known principles, methods and software within the field	Analyse a pre-defined problem and propose a log frame	Apply appropriate methods for use of combat aircraft in special missions	Analyse system restrictions of specific combat systems and weapons	Create a flight plan for a combat mission and simulate the most important situations using NATO radiotelephony phraseology	Develop a simple procedure for aircraft inspection and maintenance based on the main elements of aircraft systems (hydraulic, fuel and cabin)	Define and identify psychological terms and phenomena that influence a flight
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Calculate and present results in accordance with engineering practice	Perform analysis and present results of basic problems in the field of aeronautics	Identify technical and technological characteristics of communication and surveillance systems in air traffic control	Explain important terminology according to NATO standards	Explain the functioning of aircraft systems, related combat systems and weapons; draw schemes and describe them	Explain the influence of chemical, physical and biological factors that influence flight safety
AUTONOMY AND RESPONSABILITY						
7. Supervision and assistance in managing complex technical or professional activities or projects	Act independently in aeronautical field, carry out activities, maintain continuity in fulfilling tasks and reaching the ultimate goal at the level of acquired knowledge and competences					
8. Take responsibility for decision-making in predictable, unpredictable work or study context	Critically and self-critically evaluate arguments, assumptions, abstract concepts and data in order to make decisions					

<table>
<tr><td colspan="7">SOCIAL AND PERSONAL DEVELOPMENT</td></tr>
<tr><td>9. Familiarisation with the teamwork-specific roles, group activities and with task allocation for subordinated levels.</td><td colspan="6">Work effectively in teams and adjust to the demands of working environment</td></tr>
<tr><td>10. Self-control of the learning process, diagnosis of training needs, reflective analysis on own professional activity.</td><td colspan="6">Understand the impact of engineering on society and the environment, and show a highly moral and ethical approach in solving engineering problems and adapt to changes in technology and methods of work in the context of lifelong learning</td></tr>
<tr><td>Minimum performance standards for integrated learning outcomes assessment:</td><td>Apply knowledge and understanding of aircraft flight performance trough devising and sustaining arguments.</td><td>Communicate information, ideas, problems and solutions of use of combat aircraft in special missions</td><td>Apply knowledge and understanding of principles for determining basic tactical flight manoeuvres of an aircraft</td><td>Interpret relevant data in the field of aeronautics and air combat missions</td><td>Have developed those learning skills that are necessary to continue to undertake further study with the high degree of autonomy in solving less complex technical and technological problems</td><td>Demonstrate ability to work in medium complex projects with the proper identification and description of the professional roles at the team level and respecting the main attributes of team work</td></tr>
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9.4 Qualification Level 7 (master)

9.4.1 Description of Qualifications for Aerospace Engineering

9.4.1.1 Description for Study Programme Aerospace Engineering

Study Field ……………………………… **Study Programme** Aerospace Engineering

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title: Aerospace Engineering Qualification Level: **7 - MASTER**	Existing and possible occupations: Project design, Aerospace and aeronautical industry; Management (project management, people management), Consulting (strategic, design, manufacturing), Financing, Research laboratories, Academics,					
COMPETENCES **DESCRIPTORS**	**Technical Expertise**	**Critical thinking, evaluation and analysis**	**Management and planning**	**Leadership**	**Communication and Reporting**	**Working in multidisciplinary teams**
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Appropriate identification of advanced principles, theorems and advanced methods in mathematics, physics, solids and fluids mechanics, electronics, telecommunications, production and management.	Capacity to tackle new and unforeseen problems using acquired skills and knowledge. Capacity to develop new solutions that are proportional, adequate, and adapted to the problem at hand	Identification of concepts, theories, advanced methods and principles, technical-economic assessment, planning, programming, coordination and control of production systems or services. Capacity to intervene in all stages of conception of aerospace and aeronautical vehicles	Proper use of principles and theorems in the area in a professional environment. Capacity to lead multidisciplinary teams in context of international projects Capacity to lead, motivate, manage and mobilize teams throughout time and space.		
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Use of advanced principles, theorems and advanced methods in mathematics, physics, solids and fluids mechanics, electronics, telecommunications, production and management...		Use of concepts, theories, advanced methods and principles, technical-economic assessment, planning, programming, coordination and control of production systems or services.	Use of advanced knowledge to explain and interpret the various types of managerial decisions in the activities of aeronautical agents, in relation to the procedures established in the field and on the basis of performance indicators.		

SKILLS				
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Appropriate use of standard criteria and methods of assessment, from fundamental disciplines, for qualitative and quantitative identification, modelling, analysis and qualitative and quantitative assessment of specific phenomena and parameters, as well as for the processing and interpretation of results, from processes specific to aerospace engineering.			Develop empathy, sympathy and engagement to be capable to implement teambuilding theory and practices, as well as team engagement and leadership
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions				Capacity to develop and implement performance assessment systems or other metrics
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Ability to organize experiences, as well as analysing and interpreting results			Knowledge on global economy, and applying management methods and technics.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Ability to effectively communicate in both oral and written language and use scientific and technical communication			Ability to effectively communicate in both oral and written language and use scientific and technical communication, using modern technological tools, such as video-conference, on-line team/project management systems and others.
AUTONOMY AND RESPONSABILITY				
7. Undertaking complex and unpredictable professional tasks under autonomy and professional independence conditions.	Ability to execute tasks with large degree of autonomy, based on documentation, frameworks, and theoretical principles and methods.			
8. Assuming responsibility to manage and transform work or study context that are complex, predictable, unpredictable and require new strategic approaches.	Using acquired knowledge and skills, able to lead projects with a certain degree of autonomy. Ability to decide, even in stressful environments. Ability to analyse and synthesise, plan, and resolve complex problems.			
SOCIAL AND PERSONAL DEVELOPMENT				
9. Interaction within professional groups or institutions	Achieving specific activities and roles for teamwork on different responsibilities and distributing tasks for subordinate levels, based on communication and dialogue, co-operation, pro-active attitude and respect for others: communication skills and teamwork.			
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Objective self-evaluation of the need for professional development and openness to lifelong learning as well as effective use of language skills, knowledge of information and communication technology for personal and professional development: aware of the need for continuous training.			

Minimum performance standards for integrated learning outcomes assessment:	Demonstrate capacity to perform all the above descriptions in an autonomous and proficient way.

9.4.1.2 Description for Study Programme Avionics and Aerospace Navigation

Study Field *AEROSPACE ENGINEERING* **Study Programme AVIONICS AND AEROSPACE NAVIGATION**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title Avionics and Aerospace Navigation Qualification Level: **7 - MASTER**	Existing and possible occupations Aircraft Engineer-214506, Research Engineer in Airborne Equipment and Installations-251511, Researcher in Airborne Equipment and Plants-251510, Research Assistant in Airborne Equipment & Installations-251512, Aircraft Engineer-214537 Engineer, 251501, Engineer for Air Navigation Protection (Communications, Navigation, Surveillance) - 214548, Aeronautical Inspector-214434, Engineer / Specialist Inspector / Specialist / Expert in Air Traffic Services - 214437, Aircraft Reception and Control Engineer - Engineer Electromechanical Engineer 214420, Electromechanical Engineer - 214421; Mechanical Engineer - 214501, Mechanical Engineer Designer - 214538, Mechanical Engineering Engineer - 214509, Electrical Engineer-214312, Power Engineer 214305, Engineer Engineer-214311, Distribution Network Dispatcher-214303, Aircraft Assistant - 251503 Engineer Aircraft Research-251502, Assistant Technology Research and Unconventional Equipment - 251551, Programmer-213102, Civil Aviation Traffic Controller - 314403, Pilot Test Engineer - 214540, Teacher of Gymnasium-232201 (under the law); Teacher in high school, post-secondary, vocational and foremen education -) - 232101 (under the law), Assistant Professor - 231001, Aeronautical Inspector-214434; Aerospace Civil Engineering Research Engineer-251505, Civil Aviation Navigator - 314406, Radar Navigator Navigator-314405, Flight Navigator-314408, Radar and Non-Radar Instructor Navigator-314409, Radar-314411 Operator, radio-navigation aviation instructor - 314505, Educational inspectors - 2352; Institute Secretary, faculty - 235901, Commercial Company Manager - 121004; Deputy Director Commercial Company - 121005; General Manager of the Company - 121011; Deputy Managing Director Commercial Company - 121012; New occupations proposed for. to be inserted in COR: Prerequisites for access: A graduate of Aerospace Engineering license Recommended for Bachelor's degree programs: Aviation Equipment and Installations					
COMPETENCES **DESCRIPTORS**	Solving complex, aerospace engineering tasks using advanced knowledge of engineering sciences	Modelling, simulating, designing and analysing the performance of complex navigation systems on flight dynamics, flight qualities, command and stability of aircraft.	Modelling and analysis of space flight dynamics, design of power systems and space vehicle control systems.	Using programming languages and software implementation of data processing algorithms for avionics and aerospace applications.	Conceptual and detailed design of aerospace and avionics equipment.	Developing innovative solutions to optimize the methods of synthesizing laws governing airspace vehicles and air traffic management.
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Identification and detailed description of the theoretical concepts, principles and theoretical	Detailed definition and description of the theoretical and practical knowledge necessary for the current design,	Definition and detailed description of concepts, theories, principles of space systems engineering.	Identification and detailed description of programming languages and software packages specific to the design,	Identify and know a wide range of theories, results, concepts and procedures used to design avionics	Identification and detailed description of the concepts, theories and the results used for the analysis and optimization of the methods of

	results used in the field of aerospace engineering.	analysis and implementation of aircraft avionics systems.		simulation, analysis and implementation of data processing algorithms for aerospace and avionics equipment.	and aerospace navigation equipment.	conducting and determining the trajectories of aerospace vehicles.
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Application and correlation of fundamental theoretical knowledge to explain and interpret current constructive solutions and their tendencies in the field of avionics and navigation systems and equipment.	Using advanced theoretical and practical knowledge to explain and interpret the performances of avionics and flight control systems, in line with current requirements and trends in manoeuvrability and safety performance.	Using specialized knowledge to explain and interpret design and construction solutions specific to avionics and space navigation systems.	Using computer-aided design software packages to explain and interpret the new solutions proposed to optimize the performance of avionics equipment.	Using modern design methods to explain and interpret the constructive solutions of airline and spacecraft avionics and their integration into unconventional applications.	Using specialized knowledge to explain and argue the theoretical and constructive solutions used in complex aerospace navigation systems.
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Integrated application of a wide range of results, principles and methods from the fundamental disciplines for designing aircraft equipment and systems in accordance with aerospace engineering performance and quality standards.	Integrated application of a wide range of methods to solve new theoretical and practical problems regarding the achievement of the functions and performances of aircraft avionics and navigation equipment.	Integrating aerospace engineering theoretical knowledge to determine innovative solutions to design and optimize the performance of spacecraft's avionics equipment.	Using a variety of computer-assisted design, numerical simulation and software deployment to solve new problems with the functions and performance of avionics and aerospace navigation equipment.	Using a wide range of modelling, design and implementation techniques for aerospace and avionics equipment for new applications with complexity and high performance criteria.	Integrated knowledge of avionics and aerospace navigation to define new solutions for the synthesis of routing laws and flight trajectories.
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	Applying the results, principles and methods of the fundamental disciplines to the establishment, use of the tangible and pertinent use of the performance analysis criteria and the validation of the proposed solutions for the design and	Comparative evaluation, qualitative and quantitative performance of avionics and airborne equipment in accordance with specifications for manoeuvrability and safety performance of aircraft.	Establishment of criteria and methods for the analysis of the performance of avionics and space navigation systems, their nuanced use for finalizing constructive solutions.	Qualitative and quantitative assessment based on the use of specialized software packages for simulation, analysis and validation of hardware / software design and implementation solutions	Applying advanced criteria and methods for the comparative analysis of the performances of avionics and aerospace equipment in order to validate the proposed conceptual and constructive solutions.	Establishing and using the criteria for analyzing and validating proposed solutions for high complexity issues on optimizing aircraft trajectories and enhancing flight safety.

	implementation of avionics equipment.			for avionics and aerospace navigation equipment.		
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	The formulation of topics of professional and / or innovative research projects in the field of avionics and aerospace navigation requires the use of a broad spectrum of knowledge and results in the field of aerospace engineering.	Elaboration of professional and / or research projects for aeronautical avionics and navigation equipment aiming at optimizing flight qualities and flight safety.	Develop professional and / or research projects in the field of avionics and space navigation by including a wide range of procedural and constructive methods.	Development of professional and / or research projects covering a wide range of computer-aided design methods of avionics equipment for air and space vehicles.	Formulating themes and developing professional and / or research projects involving the use of new theoretical and practical solutions to diversify functions and optimize the performance of avionics and aerospace navigation equipment.	Formulation of themes and elaboration of professional and / or research projects to solve current and prospective problems related to the optimization of air traffic management.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Standard: The optimal solution of a wide spectrum of advanced calculations and complex problems related to the fundamental disciplines of engineering within specific tasks of aerospace engineering. Minimum level: Correct solving using advanced calculations and complex problems related to the core engineering disciplines within specific tasks of aerospace engineering.	Standard: Optimizing solutions to flight stability issues, ensuring stability, manoeuvrability and flight safety. Minimum level: Comprehensive modelling of aircraft dynamics and identification of possible theoretical and practical solutions for achieving stability and manoeuvrability performance compliant with aviation design standards.	Standard: Designing, simulating, analysing and validating the hardware and software implementation solution for satellite navigation and navigation equipment. Minimum level: Modelling, configuring and identifying solutions to achieve basic functions of satellite avionics equipment.	Standard: Designing and analysing aerospace and aerospace systems performance using specific programming languages and computer assisted design software packages. Minimum level: Simulating, analysing and optimizing the performance of aerospace avionics and navigation software using computer-assisted design software packages.	Standard: Develop a professional and / or research project for an avionics and navigation system using advanced procedures and knowledge and unconventional design techniques in aerospace engineering. Minimum level: Detailed design, simulation and performance analysis of aerospace and aerospace equipment for unconventional applications.	Standard: Solving complex problems of synthesis of routing laws with static and dynamic restrictions. Minimum level: Advanced optimal synthesis of aerospace routing laws and numerical implementation of solutions.
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictable professional	Applying the values and ethics of the engineering profession of complex professional tasks under conditions of autonomy and professional independence.					

tasks under supervision and assistance						
8. Assuming responsibility to manage and transform work or study context that are complex, predictable, unpredictable and require new strategic approaches.	Responsible execution of complex professional tasks, promoting logical, convergent and divergent reasoning, practical applicability, assessment and self-evaluation in decision-making.					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions	Performing activities with the exercise of specific roles in teamwork on different hierarchical levels and assuming leadership roles; promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism, and continually improving their own activities. (Communication, teamwork and leadership).					
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Objective self-assessment and diagnosis of the need for continuous professional training for insertion into the labor market and adaptation to the dynamics of its requirements and for personal and professional development. Self-control of learning and efficient use of language skills and knowledge of information and communication technology. (Managing continuous training).					
Minimum performance standards for integrated learning outcomes assessment:	Standard: Making year projects and dissertation work, in terms of autonomy and professional independence.	Minimum level: Achievement of year and dissertation papers with elements of scientific research and innovation, with the correct use of bibliographic sources, norms, standards and specific methods, under conditions of autonomy and professional independence, as well as their support with the demonstration of the capacity of qualitative and quantitative evaluation of technical solutions in the field and its own results.	Standard: Creating and conducting complex group projects or projects, identifying and describing professional roles at the team level; participation in research papers	Minimum level: Creating and conducting some group projects or projects, identifying and describing the professional roles at the team level and respecting the main attributes of teamwork; participating as a team member in at least one research project	Standard: Identify and diagnose the need for professional training, with reflexive analysis of their own training and professional development, self-control of learning and efficient use of communication and training resources (Internet, e-mail, databases, lectures on -line, etc.), including using foreign languages; publication of scientific papers.	Minimum level: Identify and diagnose the need for training, with satisfactory analysis of your own training and professional development, self-control of learning and the proper use of communication and training resources (Internet, e-mail, databases, courses online, etc.), including using at least one foreign language; publishing at least two articles locally

9.4.1.3 Description for Study Programme Aerospace Engineering and Management

Study Field *AEROSPACE ENGINEERING* **Study Programme AEROSPACE ENGINEERING AND MANAGEMENT**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title Aerospace Engineering and Management Qualification Level: 7 - **MASTER**	Existing and possible occupations Possible occupations according to COR: Educational inspectors - 2352; Aircraft Researcher - 25150; Commercial Company Manager - 121004; Deputy Director Commercial Company - 121005; General Manager of the Company - 121011; Deputy Managing Director Commercial Company - 121012; Sales Director - 121018; Shop Manager - 121021; Technical Director - 121024; Chief Sales Officer - 123501; Head of Deposit - 123502; Head of supply service - 123503; Programmer - 213102; Aircraft Reception and Control Engineer - 214417; Engineer electromechanical engineer - 214420, Electromechanical engineer - 214421; Aeronautical Inspector - 214434; Engineer / specialist inspector / specialist referent / air traffic services expert - 214437; Mechanical Engineer - 214501; Aircraft Engineer - 214506; Mechanical Engineer - 214509; Aircraft engineer engineer - 214537; Mechanical engineer - 214538; Engineer for the protection of air navigation (communications, navigation, surveillance) - 214548; Institute Secretary, faculty - 235901; Quality Specialist - 242301; Aircraft Research Engineer - 251502; Aircraft Assistant - 251503; Research engineer in aerospace constructions - 251505; Assistant in technology research and non-conventional equipment - 251551; Civil Aviation Traffic Controller - 314403; Pilot Test Engineer - 214540; Assistant Professor - 231001; Professor in high school, post-secondary, vocational and foremen education - 232,101 (under the law); Secondary Education Teacher - 232201 ((under the terms of the law), Aeronautical Inspector - 214434, Flight Navigator - 314408, Radar and Non-Radar Instructor Navigator - 314409, Radar Operator - 314411, Airborne Operator - 314504; aviation - 314505; • New occupantions proposed to be included in COR: Prerequisites for access: Graduate of the Aerospace Engineering field Recommended for Bachelor's degree programs: Aeronautical Engineering and Management					
COMPETENCES **DESCRIPTORS**	Solving complex, aeronautical engineering tasks using advanced knowledge from engineering managerial sciences.	Mathematical modelling and optimization of technical, economic and financial processes in general and in particular aeronautical specifics.	Integrated use of advanced software applications to solve complex tasks predominantly specific to aeronautical activities.	Conceptual and detailed design of aeronautical, optimized, innovative aeronautical processes, predominantly specific to airports and airlines.	Conceptual and detail design of global air traffic optimization systems in relation to local development features.	Developing innovative aeronautical products in relation to the requirements of international organizations by ensuring a high standard of quality, safety, security and sustainable development.
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Identification and detailed description of a wide range of concepts, principles, theorems and methods in the field of aerospace engineering using aviation specific terms.	Defining and describing broadly mathematical models for optimizing technical, economic and financial phenomena, aeronautical processes, using the appropriate language.	Detailed identification and description of a wide range of software applications and aeronautical field optimization models.	Identification of a broad spectrum of basic theories, methods and principles for the conceptual and detailed design of aeronautical activities, predominantly	Identifying a broad spectrum of basic theories, methods and principles for conceptual and detail design of global air traffic management and control systems.	Identification and detailed description of a broad spectrum of methods for the sustainable development of aeronautical activities, by ensuring, achieving and capitalizing on compliance with national / Community / international rules.

				specific to airports and airlines.		
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Explanation and interpretation with a high degree of detail of the possibilities of applying the concepts, principles, theorems and methods used in the implementation of highly segregated aeronautical projects.	The extrapolation of the main methods of technological, economic and financial optimization at the structural and managerial level, related to the global evolution of the whole field as well as to the integrating factors.	Explaining and interpreting with high degree of detail the possibilities of using software applications and optimization models for computer-aided design of products and processes characteristic of airports and airlines.	Using specialized knowledge to explain and interpret the new challenges of the field, as well as current controversies specific to national, community and international aeronautical activities	Use of expertise to explain and interpret new air traffic management technologies as integrated parts of the European Single European Sky management process.	Explaining and interpreting with high degree of detail the methodology of developing the processes implemented by ensuring, achieving and capitalizing on compliance required by specific regulations at national / community / international level.
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Integrated application of a broad spectrum of concepts, principles, theorems and methods from the fundamental engineering disciplines for advanced calculations in the design and operation of complex aeronautical systems	Integrated application of a broad spectrum of methods to optimize macroeconomic processes, based on a limited number of segregation factors.	Integrated application of a wide range of software applications and advanced optimization models for programming, simulation, computer-aided design of research projects on various practical issues in the field of airport, air traffic and airline companies.	Integrated application of a broad spectrum of principles and methods for conceptual and detail design of integrated gateway to gateway aeronautical programs.	Integrated application of a broad spectrum of principles and methods to identify the means of conceptual and detailed design of new air traffic management systems.	Integrated application of a broad spectrum of methods and means of broad-spectrum development, for the design of processes, assurance, achievement and valorisation of compliance required by specific regulations at national / community / international level.
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	Using different criteria and methods to evaluate phenomena in formulating and recommending extensive solutions for constructive development.	Evaluate and establish the most appropriate methods to optimize the studied phenomena, establish well-founded criteria for refining solutions and implementing decisions in a constructive sense.	Using different process evaluation criteria by various methods for evaluating and selecting software applications for use in modeling and simulating airport and air traffic processes.	Evaluate and establish optimal variants to ensure a high degree of functionality of airport flow processes in relation to international standards, but also with the needs of aeronautical agents.	Evaluating and establishing optimal variants of air navigation equipment and means to substantiate air traffic safety decisions in relation to international procedures and available resources.	Evaluate and establish programs on the sustainable development of aeronautical activities, in particular airports and airlines, in relation to ICAO, IATA rules.
5. Development of professional and/ or research projects	Developing professional and / or research projects	Developing projects based on various	Elaboration of professional and / or	Elaborate professional and / or research projects	Developing professional and / or research projects	Developing professional and / or applied research projects at Romanian

integrating a wide range of methods in different fields in an innovative means.	and / or projects using an innovative broad spectrum of theorems, principles and methods in the core disciplines of engineering.	methods of optimizing technical, economic and financial phenomena, leading to varied solutions in the real context of the dynamics of the international aviation market.	research projects based on various methods using different boundary situations characteristic of integrated aeronautical processes, using a wide range of methods, digital technologies and advanced software tools designed to simulate various scenarios and boundaries.	that meet current challenges and include innovative processing technologies and systems that respond to current and future traffic patterns.	using a variety of technological solutions but corroborated with international / national airworthiness rules and local resources of aeronautical agents involved.	airports, with a high degree of process / system innovation, meeting current needs for sustainable development, safety, security and quality.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Standard: The optimal solution of a wide spectrum of advanced calculations and complex problems related to the basic engineering disciplines, within specific tasks in the aeronautical field. Minimum level: Correct solving of advanced calculations and complex problems related to the core disciplines of engineering, within specific tasks in the aeronautical field.	Standard: Optimizing different types of technical, economic and financial processes based on mathematical modelling. Minimum level: Mathematical modelling of technical, economic and financial processes based on a limited number of factors of influence in the aeronautical field.	Standard: Solving complex problems with limit and procedural situations in the aeronautical field. Minimum level: Correct solving of high complexity problems in the aeronautical field regarding the programming, management and processing of experimental data, by modelling with different algorithms.	Standard: Conceptual and detailed design of complex, optimized, innovative processes tailored to current international air traffic needs Minimum level: Designing details of an airport process or an airline involved in national / international traffic.	Standard: Designing a project based on sustained research, technology optimization and / or technology allocation in relation to the predicted / determined air traffic flow needs. Minimum level: Elaborate a research project to optimize a process characteristic of predicted / determined air traffic flow.	Standard: Developing a research project based on current global development trends, with a high degree of innovation Minimum level: Develop a research project of a process / system with an innovative degree at the local level but adapted to the requirements of sustainable development at a global level and integrated with the specific international norms.
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictable professional tasks under supervision and assistance	Applying the values and ethics of the engineering profession under conditions of autonomy and professional independence.					

<table>
<tr><td>8. Assuming responsibility to manage and transform work or study context that are complex, predictable, unpredictable and require new strategic approaches.</td><td colspan="6">Responsible execution of complex professional tasks under professional independence. Promoting logical, convergent and divergent reasoning, practical applicability, assessment and self-assessment in decision-making. Responsible execution of complex professional tasks.</td></tr>
<tr><td>SOCIAL AND PERSONAL DEVELOPMENT</td><td colspan="6"></td></tr>
<tr><td>9. Interaction within professional groups or institutions</td><td colspan="6">Performing activities with the exertion of roles specific to teamwork on different hierarchical levels and assuming leadership roles. Promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism, and continually improving their own activities.
Communication, teamwork, and leadership.</td></tr>
<tr><td>10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams</td><td colspan="6">Objective self-evaluation and diagnosis of the need for continuous professional training, for the purpose of insertion into the labour market and adaptation to the dynamics of its requirements, for the personal and professional development. Self-control of learning and efficient use of language skills, knowledge of information technology and communication. Manager of his own continuous training.</td></tr>
<tr><td>Minimum performance standards for integrated learning outcomes assessment:</td><td>Standard: Carrying out research reports and projects, as well as dissertation papers, in terms of autonomy and professional independence.</td><td>Minimum level: Carrying out research reports and half-year projects for airport and aeronautical business activities as well as dissertation work with research and scientific innovation elements, with the correct use of bibliographic sources, rules, regulations and specific directives, under conditions autonomy and professional independence, as well as their support with the demonstration of qualitative and quantitative evaluation of</td><td>Standard: Creating and conducting complex group projects or projects, identifying and describing professional roles at the team level. Participation in research grants</td><td>Minimum level: Creating and conducting some group work or projects, identifying and adequately describing the professional roles at the team level and respecting the main attributes of teamwork. Participating as a team member in at least one research project</td><td>Standard: Identification and diagnosis of the need for professional training, reflective analysis of training, professional development, self-control of learning and efficient use of communication and training resources (Internet, e-mail, databases, on-the-job training) -line, etc.), including using foreign languages (English ICAO). publication of scientific papers.</td><td>Minimum level: Identify and diagnose the need for training, with a satisfactory analysis of your own training activity, professional development level, self-control of learning and the proper use of communication and training resources (Internet, e-mail, databases, on-line, etc.), including at least one foreign language (English ICAO) .; publishing at least two articles locally</td></tr>
</table>

		technical solutions in the field and their own results.				

9.4.1.4 Description for Study Programme Aerospace Propulsion, Phonic and Chemical Pollution

Study Field *AEROSPACE ENGINEERING* **Study Programme AEROSPACE PROPULSION, PHONIC AND CHEMICAL POLLUTION**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title Aerospace Propulsion, Phonic and Chemical Pollution Qualification Level: **7 - MASTER**	Existing and possible occupations Possible occupations: aviation engineer - 214506; aircraft research engineer - 251502; research engineer in aerospace constructions - 251505; research engineer in propulsion systems-251508; Aircraft Reception and Control Engineer-214417; thermic engineer-214510; engineer for the protection of air navigation (communications, navigation, surveillance) - 214548; Pilot Test Engineer-214540; research engineer in machinery and equipment - 251514; research engineer in mechanical machines and installations - 251544; chief business engineer and other business-122701; Chief Engineer-122606; engineer / specialist inspector / specialist referent / air traffic services expert - 214437; Production engineer - 214409, Research engineer in engineering in machine building - 251541, Research engineer in machine building technology - 251526, Research engineer in technology and nonconventional equipment - 251550, Head of design research workshop - 123711, Head of design research department - 123710 , Mechanical Engineer - 214501; Mechanical Engineer Advisor - 214533; Mechanical engineer specialist - 214536; Mechanical engineer - 214538; Professor in high school, post-secondary, vocational and foremen education - 232101 (provided 60 credits for pedagogical training); Professor in gymnasium education - 232201 (provided 30 credits for pedagogical training); Inspectors in education - 2352; Institute Secretary, faculty - 235901; Trainer - 241205; Professional Inspector Professional Training, Evaluation and Selection - 241218; Commercial Company Manager - 121004; Deputy Director Commercial Company - 121005; General Manager of the Company - 121011; Deputy Managing Director Commercial Company - 121012; Sales Director - 121018; Shop Manager - 121021; Technical Director - 121024; Head of repairs center - 122803; Chief Sales Officer - 123501; Head of Deposit - 123502; Head of supply service - 123503; Small business owner patron (guarantor) providing services - 131801; Purchasing analyst / consultant suppliers - 241401; Quality Specialist - 242301; Standardization Assistant - 242313; Assistant in technology research and non-conventional equipment - 251551; University assistant Prerequisites for access: Bachelor's degree in Aerospace Engineering, study programs: Propulsion Systems Recommended for license studies programs: Propulsion Systems					
COMPETENCES **DESCRIPTORS**	Solving complex complex tasks, specific to Aerospace Engineering using advanced knowledge of engineering sciences.	Mathematical-experimental modeling and optimization of processes concerning the operation of aerospace propulsion systems.	Integrated use of advanced software applications to solve complex tasks predominantly specific to aerospace propulsion and environmental protection.	Conceptual and detailed design of thermogasodinamic processes specific to optimized aerospace propulsion systems in accordance with environmental protection standards.	Conceptual and detailed design of aerospace propulsion systems and complex, innovative equipment, predominantly aerospace.	The development of innovative products with aerospace applications, but also in other fields, in accordance with the environmental protection standards and the quality assurance requirements.
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Identification and detailed description of a broad spectrum of concepts, principles, theorems and methods of basic engineering sciences (mathematics, physics, chemistry, drawing, etc.).	Defining and detailed description of a wide range of optimization and mathematical-experimental modeling methods.	Professional identification of large-use software, a broad spectrum of modeling-simulation methods, predominantly specific to aerospace propulsion systems.	Definition and detailed description of a broad spectrum of basic theories, methods and principles for the conceptual and detailed design of complex thermo-dynamic processes, with the preponderance of aerospace propulsion systems.	Definition and detailed description of a broad spectrum of basic theories, methods and principles for conceptual and detailed design of aerospace propulsion systems in compliance with the environmental protection regulations.	Detailed identification and description of a wide range of product development methods and design, assurance, achievement and capitalization of product quality in accordance with environmental protection standards.
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Explaining and interpreting with a high degree of detail the possibilities of applying concepts, principles, theorems and methods of basic engineering sciences in	Expanding / extrapolating the application of the main methods of optimization and mathematical-experimental modeling to new processes,	Explaining and interpreting the use of software applications in computer-aided design of products, processes and technologies, in modeling-simulation and in computerized	Use of specialized knowledge to explain and interpret new complex, optimized, innovative, functional functional schemes specific to aerospace propulsion systems.	Use of expertise to analyze new complex aerospace propulsion systems adapted to environmental protection requirements.	Explaining and interpreting with high degree of detail the methodology for the development of innovative products and the methods of designing, assuring, achieving and capitalizing on the quality of the products according to the environmental protection regulations.

	new projects related to the field of aerospace propulsion systems.	predominantly aerospace propulsion systems.	data processing with the preponderance of aerospace propulsion systems.			
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Integrated application of a broad spectrum of theorems, principles and methods of fundamental disciplines for advanced engineering calculations in the design and operation of aerospace propulsion systems.	Integrated application of a wide spectrum of methods for the optimization of thermogazodinamic and technological processes specific to aerospace propulsion systems.	Integration into working procedures of a wide range of advanced software applications for programming, database creation, assisted graphics, simulation, computer assisted design, computer data processing and processing, mainly aerospace propulsion systems.	Integrated application of a broad spectrum of principles and methods for conceptual and detailed design of thermogazodinamic processes and functional schemes specific to aerospace propulsion systems, complying with environmental protection standards.	Integrated application of a broad spectrum of principles and methods for conceptual design and detail of new aerospace propulsion systems conforming to environmental protection standards.	Integrated application of a wide range of methods for the development of innovative products and for the design, assurance, realization and valorisation of the products according to the environmental requirements.
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	Critical, quantitative and qualitative assessment and recommendation of solutions in diverse applications.	Assessment and establishment of the most appropriate methods for mathematical-experimental modeling and optimization of the technological processes in general and those specific to the aerospace propulsion systems.	Use tangible and relevant criteria and standard evaluation methods for selecting software applications for use in modeling aerospace propulsion systems.	Evaluating and establishing optimal variants of complex, optimized, innovative thermogazodynamic processes, specific to aerospace propulsion systems, adapted to the requirements of environmental protection.	Assessment and establishment of optimal variants of propulsion systems and complex equipment, aerospace propulsion, compliant with environmental regulations	Comparative assessment of innovation and product quality.
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Design and development of professional and / or research models and projects using innovative broad spectrum of theorems, principles and methods of fundamental subjects.	Elaboration of research projects requiring mathematical-experimental modeling and optimization.	Developing professional and / or research projects, specific to aerospace engineering in general, and aerospace propulsion systems, in particular, using a wide range of methods, digital technologies, computer systems and advanced software tolos.	Developing professional and / or research projects that include complex, optimized, innovative, aerospace propulsion systems tailored to environmental requirements.	Elaboration of professional and / or research projects on complex aerospace propulsion systems conforming to the requirements of environmental protection.	Developing professional and / or research projects for innovative, successful, high performance products.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Standard: The optimal solution of a wide range of advanced calculations and complex problems related to the fundamental disciplines of engineering within the specific tasks of aerospace engineering. Minimum level: Correct solving of advanced computations and complex problems related to the core engineering disciplines within	Standard: Optimization of different types of functional processes based on mathematical-experimental modeling. Minimum level: Mathematical-experimental modeling of the main functional processes specific to aerospace propulsion systems.	Standard: Optimal solution of complex tasks in the area of aerospace propulsion systems that require a wide range of advanced software applications. Minimum level: Correct solving of complex problems, mainly in the field of aerospace propulsion systems, regarding programming, database management, experimental data	Standard: Conceptual and detailed design of optimal, innovative thermogasodinamic processes, specific to aerospace propulsion systems that meet environmental requirements. Minimum level: Designing details of the basic thermo-basodynamic processes, specific to aerospace propulsion systems	Standard: Elaboration of a complex aerospace propulsion system project, optimal according to the environmental requirements. Minimum level: Elaboration of a classic aerospace propulsion system project, according to the environmental requirements.	Standard: Developing an innovative, successful product project with high performance according to environmental requirements. Minimum level: Elaborating a project to develop a new product with superior quality characteristics, according to the environmental requirements.

	specific aerospace engineering tasks.		processing, 2D and 3D modeling, detailed design of specific systems and subassemblies.	that meet the environmental requirements.		
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictible professional tasks under supervision and assistance	Applying the values and ethics of the engineering profession and complex professional tasks under conditions of autonomy and professional independence.					
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Responsible execution of complex professional tasks, promoting logical, convergent and divergent reasoning, practical applicability, assessment and self-evaluation in decision-making.					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions	Performing activities with the exercise of specific roles in teamwork on different hierarchical levels and assuming leadership roles; promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism, and continually improving their own activities. (Communication, teamwork and leadership).					
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Objective self-evaluation and diagnosis of the need for continuous professional training for insertion into the labor market and adaptation to the dynamics of its requirements and for personal and professional development; self-control of learning and efficient use of language skills and knowledge of information and communication technology. (Managing your own continuous training).					
Minimum performance standards for integrated learning outcomes assessment:	Standard: Making year projects and dissertation work, in terms of autonomy and professional independence.	Minimum level: Achievement of year and dissertation papers with elements of scientific research and innovation, with the correct use of bibliographic sources, norms, standards and specific methods, under conditions of autonomy and professional independence, as well as their support with the demonstration of the capacity of qualitative and quantitative evaluation of technical solutions in the field and its own results.	Standard: Creating and conducting complex group projects or projects, identifying and describing professional roles at the team level; participation in research papers.	Minimum level: Creating and conducting some group projects or projects, identifying and describing the professional roles at the team level and respecting the main attributes of teamwork; participating as a team member in at least one research project.	Standard: Identify and diagnose the need for professional training, with reflexive analysis of their own training and professional development, self-control of learning and efficient use of communication and training resources (Internet, e-mail, databases, lectures on -line, etc.), including using foreign languages; publication of scientific papers.	Minimum level: Identify and diagnose the need for training, with satisfactory analysis of your own training and professional development, self-control of learning and the proper use of communication and training resources (Internet, e-mail, databases, courses online, etc.), including using at least one foreign language; publishing at least two articles locally.

9.4.1.5 Description for Study Programme Aerospace Structures

Study Field *AEROSPACE ENGINEERING* **Study Programme AEROSPACE STRUCTURES**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title Aerospace Structures Qualification Level: **7 - MASTER**	Existing and possible occupations Possible occupations: Aircraft Engineer - 214506, Aircraft Engineer - 213506, Aircraft Reception and Control Engineer - 214417, Aircraft Engineer Engineer - 214537, Aircraft Reception and Control Engineer 214417, Head of Service, Center, Station, Airport and Assimilation - airplanes and aviation engines - 214527, Aviation Technician - 311404, Civil Aviation Traffic Controller - 314403, Mechanical Aviation - 723201, Mechanical Machining Engineer / Sub Engineer - 214545; Engineering engineer - 214404, Production engineer - 214409, Research engineer in technical engineering in machine building - 251541, Research engineer in machine building technology - 251526, Research engineer in technology and nonconventional equipment - 251550, Head of design research workshop - 123711, Design Research Section - 123710, Mechanical Engineer - 214501; Railway rolling stock engineer - 214504; Mechanical Technological Equipment Engineer - 214513; Mechanical engineer engineer - 214514; Mechanical engineer for construction equipment - 214517; Engineer - 214507; Mechanical Engineer Advisor - 214533; Mechanical engineer specialist - 214536; Mechanical engineer - 214538; Mechanical Maintenance Specialist Industrial Equipment - 214544; Production System Trainer - 214905; Developer / Manufacturing Developer - 241302; Teacher in high school, post-secondary, vocational and foremen education - 232101 (under the law); Teacher in gymnasium education - 232201 (under the law); Inspectors in education - 2352; Institute Secretary, faculty - 235901; Trainer - 241205; Professional Inspector Professional Training, Evaluation and Selection - 241218; Commercial Company Manager - 121004; Deputy Director Commercial Company - 121005; General Manager of the Company - 121011; Deputy Managing Director Commercial Company - 121012; Sales Director - 121018; Shop Manager - 121021; Technical Director - 121024; Head of repairs center - 122803; Chief Sales Officer - 123501; Head of Deposit - 123502; Head of supply service - 123503; Small business owner patron (guarantor) providing services - 131801; Purchasing analyst / consultant suppliers - 241401; Quality Specialist - 242301; Standardization Assistant - 242313; Research Assistant in Process Equipment - 251520; Research Assistant in Machine Building Technology - 251527; Research Assistant in Port Facility and Equipment - 251536; Research assistant in technical creation in machine building - 251542; Research Assistant in Mechanical Machines and Installations - 251545; Research assistant in oil storage facilities and equipment - 251548; Assistant in technology research and non-conventional equipment - 251551; Assistant Professor - 231001 **New occupations proposed for. to be inserted in COR:** Prerequisites for access: Bachelor's degree in Aerospace Engineering, Aerospace Studies, Aerospace Propulsion Systems, Aviation Equipment and Installations, Aeronautical Engineering and Management					
COMPETENCES **DESCRIPTORS**	Critical analysis, testing and evaluating the performance of advanced aerospace engineering physics and mathematical models in conducting calculations, demonstrations and applications to solve tasks specific to aerospace engineering.	Design and optimize the overall shape and structure of a flight deck as well as on-board facilities.	Numerical simulation, the use of advanced software applications and experimental testing at the level and detail of aerospace structures and on-board facilities.	Professional diagnosis in the field of designing and manufacturing of aerospace structures and on-board facilities.	Organization and scientific and technical coordination of testing of on-board structures and installations.	Providing consultancy and training for aerospace engineering applications.
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Description and definition of physical and mathematical models in rational, aerodynamic and hydraulic mechanics, dynamics of atmospheric and extra-atmospheric flight, elasticity theory, and numerical analysis; their proper use in professional	Description and definition of methods for pre-dimensioning, checking and dimensioning the primary structure and on-board facilities; their proper use in professional communication with different professional backgrounds.	Identification and description of numerical methods, programming languages and experimental techniques specific to structural analysis and on-board hydro-pneumatic installations; their proper use in professional communication	Description and definition of diagnostic methods in theoretical analysis and aerospace structures; the proper use of terminology, methods and paradigms in professional communication with different professional backgrounds.	Description and definition of methods of critical analysis of organization of design and testing of aerospace structures and on-board facilities; the proper use of terminology, methods and paradigms in professional communication	Identify and describe in detail a wide range of consulting and professional training methods.

	communication with different professional backgrounds.		with different professional backgrounds.		with different professional backgrounds.	
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Using the in-depth knowledge of the above-mentioned basic and specialized disciplines to explain and interpret new situations in the context of aerospace engineering and mechanical engineering in general.	Expanding / extrapolating the application of the main optimization methods and mathematical-experimental modeling to new processes, predominantly aerospace structures and on-board installations.	Extensive explanation and interpretation of the possibilities of using software applications in computer-aided design of structures, processes and technologies, modeling and simulation of computerized data processing with the specificity of Aerospace Constructions.	Using in-depth knowledge to interpret real-life situations relating to the design and fabrication of aerospace structures.	Using in-depth knowledge to interpret real-life situations regarding aerospace structures testing.	Explaining and interpreting the methodology of providing professional level consultancy with a high degree of detail.
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Integrated use of the conceptual and methodological device in completely different situations to solve new theoretical and practical problems in the field of aerospace engineering or in the more general context of mechanical engineering.	Integrated application of a wide range of methods for the optimization of mathematical and experimental modeling assemblies and subassemblies.	Integrated application of a wide range of advanced software applications for programming, database creation, assisted graphics, simulation, computer-aided design, computer data processing and processing, predominantly Aerospace Constructions.	Integrated use of the conceptual and methodological device in completely different situations to solve new theoretical and practical problems in the field of aerospace engineering or in a more general context of mechanical engineering.	Integrated application of a broad spectrum of principles and methods for conceptual design and detail of new complex technological systems, specific to aerospace engineering or in a more general context of mechanical engineering.	Integrated application of a wide range of methods for the development of innovative elements in providing consulting and training.
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	Critical, quantitative and qualitative assessment and recommendation of solutions in various applications in the field of aerospace engineering.	Evaluating and establishing the most appropriate methods for mathematical-experimental modeling and structure optimization.	Tailored and relevant use of criteria and standard evaluation methods for the selection of software applications for their use in the experimental testing at an overall and detailed level of aerospace structures and on-board facilities.	Use tangible and relevant criteria and evaluation methods to formulate valuable judgments and substantiate constructive decisions in the field of aerospace engineering or in a more general context of mechanical engineering.	Evaluating and establishing optimal variants of complex systems testing systems, specific to aerospace engineering.	Evaluating and establishing optimal variants of training and professional counseling systems.
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Design and development of professional and / or research models and projects using innovative broad spectrum of theorems, principles and methods of fundamental subjects.	Elaboration of research projects requiring mathematical-experimental modeling and optimization.	Developing professional and / or research projects, specific to Aerospace Engineering in general, and Aerospace Constructions, in particular, using a wide range of methods, digital technologies, computer systems and advanced software tools.	Performing professional diagnoses, using innovative a wide range of quantitative and qualitative methods in the field of aerospace engineering or in the more general context of mechanical engineering.	Development of professional and / or research projects of complex systems and equipment, specific to aerospace engineering or in a more general context of mechanical engineering.	Elaboration of professional and / or research projects and consultancy in the field of aerospace engineering.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Standard: The optimal solution of a wide spectrum of advanced calculations and complex problems related to the fundamental disciplines of engineering within the specific tasks of aerospace engineering. Minimum level:	Standard: Optimizing different types of structural subassemblies and onboard equipment. Minimum level: The mathematical-experimental modeling of the main physical processes that occur in the	Standard: Optimal solution of complex tasks, predominantly in the field of structural computing, requiring a wide range of advanced software applications. Minimum level: Correct solving of complex problems, with the preponderance of structural calculation regarding programming,	Standard: Conceptual and detailed design of a manufacturing technology and a complex, optimal, innovative industrial system specific to mechanical and especially aeronautical constructions. Minimum level:	Standard: Elaboration of a methodology for the realization and testing of a complex project specific to aerospace constructions. Minimum level: Elaboration of a project of complex project specific to aerospace constructions.	Standard: Develop a high-performance consulting and / or training project. Minimum level: Develop a high-quality consulting and / or training project.

	Correct solving of advanced calculations and complex problems related to the fundamental disciplines of engineering within specific tasks of aerospace engineering.	calculation and design of aerospace structures.	database management, experimental data processing, 2D and 3D modeling, detailed product design and complex industrial systems.	Designing the details of a manufacturing technology or an aerosspatial construction system.		
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictible professional tasks under supervision and assistance	Applying the values and ethics of the engineering profession and complex professional tasks under conditions of autonomy and professional independence.					
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Responsible execution of complex professional tasks, promoting logical, convergent and divergent reasoning, practical applicability, assessment and self-evaluation in decision-making.					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions	Performing activities with the exercise of specific roles in teamwork on different hierarchical levels and assuming leadership roles; promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism, and continually improving their own activities. (Communication, teamwork and leadership).					
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Objective self-evaluation and diagnosis of the need for continuous professional training for insertion into the labor market and adaptation to the dynamics of its requirements and for personal and professional development; self-control of learning and efficient use of language skills and knowledge of information and communication technology. (Managing your own continuous training).					
Minimum performance standards for integrated learning outcomes assessment:	Standard: Making year projects and dissertation work, in terms of autonomy and professional independence.	Minimum level: Achievement of year and dissertation papers with elements of scientific research and innovation, with the correct use of bibliographic sources, norms, standards and specific methods, under conditions of autonomy and professional independence, as well as their support with the demonstration of the capacity of qualitative and quantitative evaluation of technical solutions in the field and its own results.	Standard: Creating and conducting complex group projects or projects, identifying and describing professional roles at the team level; participation in research papers	Minimum level: Creating and conducting some group projects or projects, identifying and describing the professional roles at the team level and respecting the main attributes of teamwork; participating as a team member in at least one research project	Standard: Identify and diagnose the need for professional training, with reflexive analysis of their own training and professional development, self-control of learning and efficient use of communication and training resources (Internet, e-mail, databases, lectures on -line, etc.), including using foreign languages; publication of scientific papers.	Minimum level: Identify and diagnose the need for training, with satisfactory analysis of your own training and professional development, self-control of learning and the proper use of communication and training resources (Internet, e-mail, databases, courses online, etc.), including using at least one foreign language; publishing at least two articles locally

9.4.2 Description of Qualifications for Computer & Information Technology

9.4.2.1 Description for Study Programme eGovernance

Study Field *Computer & Information Technology* **Study Programme/ eGovernance**

Grid 1 – *Description of study programme by means of learning outcomes*

Qualification Title **eGovernance** Qualification Level: **7 - MASTER**	Existing and ppossible occupations 213905 Inginer de sistem software, 213101 Analist, 213103 Proiectant sisteme informatice, 213104 Consultant în informatică, 214419 Proiectant inginer de sisteme si calculatoare, 241919 Manager de proiect, Auditor sisteme informatice, Arhitect sisteme TIC pentru servicii, Consultant SOA, Expert operatii pentru servicii informatice, Integrator de sistem, Cibernetică					
COMPETENCES **DESCRIPTORS**	**C1** Operation with concepts and scientific methods in computers and information technology	**C2** Modeling and Implementing E-Governance Streams	**C3** Design and development of eGovernment services	**C4** Solving e-Government issues using tools in service science and computer science and engineering	**C5** Audit of eGovernment systems and services	**C6** Scientific research in eGovernment services
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	**C1.1** Detailed description of concepts related to computer system components for e-government systems	**C2.1** Identifying and describing business process flows in eGovernment services	**C3.1** Detailed description of concepts, theories and basic methods specific to eGovernment services	**C4.1** Detailed description of the defining elements of e-government issues	**C5.1** Identification of indicators and quality and security factors associated with IT systems	**C6.1** Defining interdisciplinary concepts as well as creativity methods and techniques
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	**C1.2** Using theories and specific tools to explain the interaction of components and the functioning of e-government information systems	**C2.2** Using Business Flow Process Modeling Methods to Explain the Deployment of eGovernment Services	**C3.2** Use of computer tools and information technology to explain the concepts of e-government systems	**C4.2** Using domain-specific theories and tools to explain the methods and techniques applicable to e-government solutions	**C5.2** Explanation of audit methods specific to IT systems	**C6.2** Explaining the interdependence of elements of e-government systems
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	**C1.3** Building models for different components of e-government systems	**C2.3** Developing models and implementing workflows of business processes in the case of partially-defined e-government services	**C3.3** Apply basic methods and principles for developing components of e-government systems	**C4.3** Applying the basic principles and methods for analyzing and solving complex problems.	**C5.3** Adapting audit methods for e-government information technology processes	**C6.3** Applying methods and creativity to developing original components of e-government systems

4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	**C1.4** Choosing the criteria and methods for assessing the quality, performance and limits of e-government systems	**C2.4** Assessing the effectiveness of eGovernment services based on business process workflow analysis	**C3.4** Comparative, including experimental, assessment of constructive solutions for e-government systems	**C4.4** Choosing the Criteria and Methods of Assessing the Quality, Performance and Limits of E-Governance Methods and Techniques	**C5.4** Modeling systems for analyzing the quality and security of IT systems	**C6.4** Benchmarking, including experimental, of the original solutions developed for e-government systems
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	**C1.5** Development and implementation of professional and / or research projects for the theoretical foundation of e-government systems	**C2.5** Developing e-government service models by integrating workflows	**C3.5** Developing professional solutions for the design and development of e-government systems	**C4.5** Development and implementation of professional and / or research projects by combining the methods and techniques applicable to e-government issues	**C5.5** Performing an eGovernment system audit	**C6.5** Developing original solutions for e-government systems
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Performing a synthesis work in the field using various sources of documentation.					
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictable professional tasks under autonomy and professional independence conditions.	Designing complex research projects					
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Carrying out team research projects, taking on coordination roles					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions	Taking co-ordination roles into project teams					
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Performing a synthesis work in the field that involves enriching the level of knowledge in the development team.					
Minimum performance standards for integrated learning outcomes assessment:	Modeling a Typical Engineering Problem Using the Formal Appliance	Modeling the business processes of a given e-government service	Designing a typical eGovernment service project	Implement a complex e-government service application	Elaboration of the plan of measures and methods used for a case study of an information system analysis	Achieving an original eGovernment service project

9.4.2.2 Description for Study Programme Advanced software services

Study Field Computer & Information Technology **Study Programme Advanced software services**

Grid 1 – Description of study programme by means of learning outcomes

Qualification Title **Advanced software services** Qualification Level: **7 - MASTER**	Existing and ppossible occupations 213905 Inginer de sistem software, 213101 Analist, 213103 Proiectant sisteme informatice, 213104 Consultant în informatică, 214419 Proiectant inginer de sisteme si calculatoare, 241919 Manager de proiect, 213104 Consultant în informatică, Auditor sisteme informatice, Arhitect sisteme TIC pentru servicii, Consultant SOA, Expert operatii pentru servicii informatice, Integrator de sistem,					
COMPETENCES **DESCRIPTORS**	**C1** Operation with concepts and scientific methods in computers and information technology.	**C2** Modeling and implementing business process flows in various areas	**C3** Design and development of software services	**C4** Problem solving using the tools of computer science and computer engineering	**C5** Audit of computer systems and services	**C6** Scientific research in the field of software services
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	**C1.1** Detailed description of the concepts of advanced software components	**C2.1** Identifying and describing business process flows in various areas	**C3.1** Description of concepts, theories and basic methods specific to software services	**C4.1** Detailed description of the defining elements of software-related issues	**C5.1** Identification of indicators and quality and security factors associated with software systems	**C6.1** Defining interdisciplinary concepts as well as creativity methods and techniques.
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	**C1.2** Using theories and specific tools to explain the interaction of components and the operation of advanced software systems	**C2.2** Using business process flow modeling methods to explain software services deployment	**C3.2** Use of computer and information technology tools to explain concepts related to software systems	**C4.2** Using domain-specific theories and tools to explain the functioning of methods and techniques applicable to solutions to software service issues	**C5.2** Explanation of audit methods specific to IT systems	**C6.2** Explaining the interdependence of advanced software elements
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	**C1.3** Building models for different components of advanced software systems	**C2.3** Developing models and implementing workflows of business processes for partially defined software services	**C3.3** Application methods and principles for developing software components	**C4.3** Applying the basic principles and methods for analyzing and solving complex problems by combining methods and techniques applicable to software-related issues	**C5.3** Adaptation of audit methods for computer software processes	**C6.3** Applying creative methods and techniques to develop original components of advanced software systems
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	**C1.4** Choosing the criteria and methods for assessing the quality, performance and	**C2.4** Assessing the effectiveness of software services based on analysis of business processes workflows	**C3.4** Comparative assessment, including experimental, of constructive software solutions	**C4.4** Choosing the criteria and methods for assessing the quality, performance and limitations of methods and	**C5.4** Modeling systems for analyzing the quality and security of	**C6.4** Comparative evaluation, including experimental, of the original solutions developed for advanced software systems

	limits of advanced software systems			techniques applicable to software-related issues	advanced software systems	
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	**C1.5** Development and implementation of professional and / or research projects for the theoretical foundation of advanced software systems	**C2.5** Developing software service models by integrating workflows	**C3.5** Developing professional solutions for the design and development of software services	**C4.5** Development and implementation of professional and / or research projects by combining methods and techniques applicable to software-related issues	**C5.5** Performing a software system audit	**C6.5** Developing original solutions for advanced software systems
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Performing a synthesis work in the field using various sources of documentation.					
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictable professional tasks under autonomy and professional independence conditions.	Designing complex research projects					
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictable and require new strategic approaches.	Carrying out team research projects, taking on coordination roles					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions	Taking co-ordination roles into project teams					
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Performing a synthesis work in the field that involves enriching the level of knowledge in the development team.					
Minimum performance standards for integrated learning outcomes assessment:	Modeling a Typical Engineering Problem Using the Formal Appliance	Modeling the business processes of a given software service	Designing a typical software service project	Implement a complex software application	Elaborate the plan of measures and methods used for a case study analysis of a software service	Performing an original software service project

9.4.3 Description of Qualifications for Aeronautics

9.4.3.1 Description for Study Programme Aeronautics

Study Field*AERONAUTICS* **Study ProgrammeGRADUATE UNIVERSITY STUDY PROGRAME OF AERONAUTICS**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title .... Qualification Level: **7 - MASTER**	Existing and possible occupations: Project engineer					
COMPETENCES **DESCRIPTORS**	Apply theoretical principles and have advanced knowledge to solve complex aeronautical problems	Provide technical and technological solutions and define appropriate processes in the field of aeronautics	Use techniques to model and simulate a system using advanced tools in the field of aeronautics	Apply information and communication technologies in the field of aeronautics	Solve complex problems in the field of aeronautics	Present problems and solutions in a multidisciplinary research team and transfer the acquired knowledge and skills
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Know the principles of transonic and supersonic aerodynamics and principles of helicopter flight	Define terminology and identify physical quantities of the air related to aviation emissions	Define and identify different types of aircraft structural loads and their impact on functionality, durability and reliability	Know terminology related to air reconnaissance and air surveillance along with a description of sensor properties	Know and understand technological processes used during inspection and maintenance of an aircraft	Define techniques, tools and methods of quality assurance in aviation
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Analyse changes of physical quantities and of an airflow at high speeds	Apply methods for measuring and determining aircraft emissions	Describe material fatigue and the main factors for its occurrence	Calculate physical quantities, parameters and properties of images and objects on images	Plan processes of aircraft maintenance in accordance with requirements	Apply and integrate methods and procedures of quality assurance in aviation
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Use tables, charts and software packages to calculate characteristics of air flow or flight at high speeds	Create and develop procedures to reduce the impact of aviation emissions on the environment	Apply methods for improvement of aircraft structures in order to prevent material fatigue	Analyse and classify objects on images using different software packages	Explain the requirements for aircraft structural reliability and reliability of aircraft operations in relation to technical conditions of an aircraft	Explain and interpret norms and requirements related to aviation personnel training, operations and maintenance
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	Design autopilot system components with application on aircraft guidance and control	Estimate the impact of aviation emissions on the environment and human health	Identify processes and phases of aircraft maintenance	Calculate and estimate the success of air reconnaissance and air surveillance missions using appropriate settings	Apply norms and requirements related to aircraft operations and maintenance	Explain quality assurance organisation scheme and quality assurance processes in aviation training centres

5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Calculate airplane or helicopter performance changing flight parameters and using advanced simulation methods	Reduce the impact of aircraft emissions in different phases of flight applying appropriate methods	Apply requirements related to aircraft operations and maintenance	Design and couple devices, systems and platforms for the conduct of air reconnaissance and air surveillance	Design a theoretical/generic model of a specific aircraft system and calculate its reliability	Be familiar with and understand fundamental principles of auditing and creating check-lists related to aircraft operations, aircraft maintenance and aviation personnel training
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Manage a process of preparing, developing and applying project technical documentation based on experimental determination of some aerodynamic parameters	Describe the requirements of emissions trading system in aviation and the principles of efficient fuel consumption	Describe technologies and processes used during aircraft maintenance and inspection	Plan air reconnaissance and air surveillance operations and missions	Apply methodology for aircraft operations and maintenance	Create quality assurance plans in accordance with requirements
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictable professional tasks under autonomy and professional independence conditions.	Act independently in aeronautical field, carry out activities, maintain continuity in fulfilling tasks and reaching the ultimate goal at the level of acquired knowledge and competences					
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Critically and self-critically evaluate arguments, assumptions, abstract concepts and data in order to make decisions					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions	Work effectively in teams and adjust to the demands of working environment					
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Understand the impact of engineering on society and the environment, and show a highly moral and ethical approach in solving engineering problems and adapt to changes in technology and methods of work in the context of lifelong learning					
Minimum performance standards for integrated learning outcomes assessment:	Apply knowledge and understanding and problem-solving abilities in new multidisciplinary context related to aerodynamics and theory of flight	Formulate judgements and propose solutions based on relevant methods in the field of aeronautics	Demonstrate critical awareness of knowledge issues in the field and at the interface between different fields	Develop new skills in response to emerging knowledge and techniques related to information and communication technologies in the field of aeronautics	Demonstrate leadership and innovation in work and study context in technological processes related to aircraft maintenance	Demonstrate experience of operational interaction in managing change

9.4.3.2 Description for Study Programme Mechanical Engineering

Study Field .... **Study Programme/ Training programme Mechanical Engineering**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title: Mechanical Engineering Qualification Level: **7 - MASTER**	Existing and possible occupations: Project Offices; Companies linked to the construction sector; Infrastructure companies (water, drainage, electricity, gas, transportation networks); Central, regional and local authorities; Operations maintenance and management activities; Project evaluation and consultancy in service companies (banks and insurance companies); Technological research and development laboratories; Technical and commercial activities. Financing, Research laboratories, Academics,					
COMPETENCES **DESCRIPTORS**	**Technical Expertise**	**Critical thinking, evaluation and analysis**	**Management and planning**	**Leadership**	**Communication and Reporting**	**Working in multidisciplinary teams**
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Appropriate identification of advanced principles, theorems and advanced methods in mathematics, technical drawing and programming, theoretical models in physics, chemistry and structural mechanics.	Capacity to tackle new and unforeseen problems using acquired skills and knowledge. Capacity to develop new solutions that are proportional, adequate, and adapted to the problem at hand	Identification of concepts, theories, advanced methods and principles, technical-economic assessment, planning, programming, coordination and control of production systems or services.	Proper use of principles and theorems in the area in a professional environment. Capacity to lead multidisciplinary teams in context of international projects Capacity to lead, motivate, manage and mobilize teams throughout time and space.		
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Use of advanced principles, theorems and advanced methods in mathematics, technical drawing and programming, theoretical models in physics, chemistry and structural mechanics		Use of concepts, theories, advanced methods and principles, technical-economic assessment, planning, programming, coordination and control of production systems or services.	Use of advanced knowledge to explain and interpret the various types of managerial decisions in the activities of aeronautical agents, in relation to the procedures established in the field and on the basis of performance indicators.		
SKILLS						

3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Appropriate use of standard criteria and methods of assessment, from fundamental disciplines, for qualitative and quantitative identification, modeling, analysis and qualitative and quantitative assessment of specific phenomena and parameters, as well as for the processing and interpretation of results, from processes specific to civil engineering.			Develop empathy, sympathy and engagement to be capable to implement teambuilding theorys and practices, as well as team engagement and leadership
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions				Capacity to develop and implement performance assessment systems or other metrics
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Ability to organize experiences, as well as analysing and interpreting results			Knowledge on global economy, and applying management methods and technics.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Ability to effectively communicate in both oral and written language and use scientific and technical communication			Ability to effectively communicate in both oral and written language and use scientific and technical communication, using modern technological tools, such as video-conference, on-line team/project management systems and others.
AUTONOMY AND RESPONSABILITY				
7. Undertaking complex and unpredictable professional tasks under autonomy and professional independence conditions.	Ability to execute tasks with large degree of autonomy, based on documentation, frameworks, and theoretical principles and methods.			
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Using acquired knowledge and skills, able to lead projects with a certain degree of autonomy. Ability to decide, even in stressful environments. Ability to analyse and synthesise, plan, and resolve complex problems.			
SOCIAL AND PERSONAL DEVELOPMENT				
9. Interaction within professional groups or institutions	Achieving specific activities and roles for teamwork on different responsibilities and distributing tasks for subordinate levels, based on communication and dialogue, co-operation, pro-active attitude and respect for others: communication skills and teamwork.			
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Objective self-evaluation of the need for professional development and openness to lifelong learning as well as effective use of language skills, knowledge of information and communication technology for personal and professional development: aware of the need for continuous training.			
Minimum performance standards for integrated learning outcomes assessment:	Demonstrate capacity to perform all the above descriptions in an autonomous and proficient way.			

9.4.3.2. Description for Study Programme Mechanical Engineering?

Study Field .... **Study Programme Mechanical Engineering**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title: Mechanical Engineering Qualification Level: **7 - MASTER**	Existing and possible occupations: Project design, Industries of design of mechanical and thermal equipment, Energy production and climatization companies, Management (project management, people management), Consulting (strategic, design, manufacturing), Financing, Research laboratories, Academics,

COMPETENCES / DESCRIPTORS	Technical Expertise	Critical thinking, evaluation and analysis	Management and planning	Leadership	Communication and Reporting	Working in multidisciplinary teams
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Appropriate identification of advanced principles, theorems and advanced methods in mathematics, technical drawing and programming, theoretical models in physics, chemistry and mechanics..	Capacity to tackle new and unforeseen problems using acquired skills and knowledge. Capacity to develop new solutions that are proportional, adequate, and adapted to the problem at hand	Identification of concepts, theories, advanced methods and principles, technical-economic assessment, planning, programming, coordination and control of production systems or services.	Proper use of principles and theorems in the area in a professional environment. Capacity to lead multidisciplinary teams in context of international projects Capacity to lead, motivate, manage and mobilize teams throughout time and space.		
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Use of advanced principles, theorems and advanced methods in mathematics, technical drawing and programming, theoretical models in physics, chemistry and mechanics of continuous environments.		Use of concepts, theories, advanced methods and principles, technical-economic assessment, planning, programming, coordination and control of production systems or services.	Use of advanced knowledge to explain and interpret the various types of managerial decisions in the activities of aeronautical agents, in relation to the procedures established in the field and on the basis of performance indicators.		
SKILLS						
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Appropriate use of standard criteria and methods of assessment, from fundamental disciplines, for qualitative and quantitative identification, modeling, analysis and qualitative and quantitative assessment of specific			Develop empathy, sympathy and engagement to be capable to implement teambuilding theorys and practices, as well as team engagement and leadership		

4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	phenomena and parameters, as well as for the processing and interpretation of results, from processes specific to aerospace engineering.			Capacity to develop and implement performance assessment systems or other metrics
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Ability to organize experiences, as well as analysing and interpreting results			Knowledge on global economy, and applying management methods and technics.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Ability to effectively communicate in both oral and written language and use scientific and technical communication			Ability to effectively communicate in both oral and written language and use scientific and technical communication, using modern technological tools, such as video-conference, on-line team/project management systems and others.
AUTONOMY AND RESPONSABILITY				
7. Undertaking complex and unpredictable professional tasks under autonomy and professional independence conditions.	Ability to execute tasks with large degree of autonomy, based on documentation, frameworks, and theoretical principles and methods.			
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Using acquired knowledge and skills, able to lead projects with a certain degree of autonomy. Ability to decide, even in stressful environments. Ability to analyse and synthesise, plan, and resolve complex problems.			
SOCIAL AND PERSONAL DEVELOPMENT				
9. Interaction within professional groups or institutions	Achieving specific activities and roles for teamwork on different responsibilities and distributing tasks for subordinate levels, based on communication and dialogue, co-operation, pro-active attitude and respect for others: communication skills and teamwork.			
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Objective self-evaluation of the need for professional development and openness to lifelong learning as well as effective use of language skills, knowledge of information and communication technology for personal and professional development: aware of the need for continuous training.			
Minimum performance standards for integrated learning outcomes assessment:	Demonstrate capacity to perform all the above descriptions in an autonomous and proficient way.			

9.5 New Qualifications

9.5.1 Description for Study Programme Green, Smart and Integrated Transport and Logistics

Study Field *ENGINEERING* **Study Programme Green, Smart and Integrated Transport and Logistics**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title Green, Smart and Integrated Transport and Logistics Qualification Level: **7 - MASTER**	Existing and possible occupations Aviation and Environmental Specialist, Environmental Analyst, Aviation Planner, Aviation Development Manager, Aviation Programs Engineer, Aviation Project Engineer, Aviation Planner Engineer, Logistics Management Specialist, Aviation and Logistics Program Advisor, Logistics Manager, Logistics Development Specialist, Logistics Support Specialist, Aviation Safety Coordinator, Safety Inspector, Aviation Safety Reporting Coordinator, Survey Technician, Operations Manager Prerequisites for access: Graduate of Engineering field; holding a Bachelor of Science in Engineering, Bachelor in Aerospace Engineering, Bachelor in Transport Engineering, Bachelor in Economics or a Bachelor of Natural Science. Recommended for Bachelor's degree programs: Green, Smart and Integrated Transport and Logistics					
COMPETENCES **DESCRIPTORS**	Solving complex, engineering tasks using advanced knowledge from land, sea, and air transport engineering sciences.	Modeling, simulating, designing, analyzing and optimizing the performance of complex technical and economic processes in the fields of land, sea, and aeronautical engineering.	The use of advanced software applications at the level and detail, specific to integrated transport and logistics activities.	Professional, conceptual and detailed design of optimized, innovative, efficient and sustainable transport and logistic processes.	Conceptual and detailed design of integrated transport and logistics optimization in relation to global development features.	Developing innovative solutions and products in relation to the requirements of international organizations by ensuring a high standard of quality and sustainable development in traffic management.
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments;	Identification, description and definition of a wide range of concepts, principles, theorems and methods in the field of transport engineering, used in professional communication with different professional backgrounds.	Detailed definition and description of the theoretical and practical knowledge necessary for the current design, analysis and implementation of amart transport and logistics processed.	Definition and detailed description of a wide range of concepts, theories, and principles in transport engineering.	Identification and detailed description of basic theories, methods and principles for the conceptual and detailed design of transport activities;	Identify and know a wide range of theories, results, concepts and procedures used in efficient transport and logistics.	Identify and describe in detail a wide range of professional training methods for the sustainable development of integrated transport activities.
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Using the in-depth knowledge of software technology, data science, planning methods, operations research, assessment and management to explain and	Using advanced theoretical and practical knowledge to explain and interpret the performances of land, sea, and aeronautical transport systems, in line with	Explaining and interpreting with high degree of detail the possibilities of using software applications and optimization models for computer-aided design of products and	Using specialized knowledge to explain and interpret the the new solutions proposed to optimize the performance of transportation systems.	Using modern design methods and expertise to explain and interpret the constructive solutions of management process.in different types of transport.	Using specialized knowledge for explaining and interpreting theoretical and constructive solutions required by specific regulations to transport engineering.

	interpret new situations in the context of transport engineering.	current requirements, trends and safety performance.	processes characteristic to innovative and advanced sustainable systems for transportation and logistics.				
SKILLS							
3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Integrated application of a wide range of concepts, principles, theorems and methods from the fundamental engineering disciplines for advanced calculations in the design and operation of complex transportation systems.	Integrated application of a broad spectrum of methods to solve new theoretical and practical problems and optimize sustainable transport and logistics.	Integrated application of a wide range of software applications and advanced optimization models for programming, simulation, computer-aided design of research projects on various practical issues in the field of transport sercices and systems.	Integrated use of the conceptual and methodological principles in completely different situations to solve new theoretical and practical problems.	Integrated application of a broad spectrum of principles and methods for conceptual design and detail of new complex technological systems, specific to transport engineering.	Integrated application of a wide range of methods for the development of innovative elements in providing new smart, green and integrated transport solutions.
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	Applying the results, principles and methods of the fundamental disciplines to the establishment, use of the tangible and pertinent use of the performance analysis criteria and the validation of the proposed solutions for the integration of land, sea, and aeronautical transportation.	Comparative evaluation of the performance of transport equipments in accordance with specifications for safety performance.	Establishment of criteria and methods for the analysis of the performance of different transportation systems.	The assessment of the use of specialized software packages for simulation, analysis, validation and implementation of optimal solutions for integrated transport.	Evaluating and establishing optimal solutions for substantiating transportation safety decisions in relation to international regulations and procedures and available resources.	Evaluating and establishing programs on the sustainable development of activities, in relation to international regulations.
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Design and development of professional and/or research projects using innovative broad spectrum of theorems, principles and methods of fundamental subjects.	Elaboration of professional and/or research projects requiring mathematical-experimental modeling and optimization.	Elaboration of professional and/or research projects spectific to trasnport engineering, based on various methods, using digital technologies and advanced software tools designed to simulate various scenarios for intelligent transport systems and ICT.	Elaborate professional and/or research projects that meet current challenges in transportation and include innovative processing technologies and systems that respond to current and future traffic performances.	Development of professional and / or research projects of complex systems and equipment, specific to transport engineering.	Elaboration of professional and/or research projects and consultancy in the field of land, sea, and aeronautical transportation engineering.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Standard: The optimal solution of a wide range of advanced calculations and complex problems related to the fundamental disciplines of engineering within the specific tasks of transport engineering. Minimum level: Correct solving of advanced computations and complex	Standard: Optimization of different types of functional processes based on mathematical-experimental modeling. Minimum level: Mathematical-experimental modeling of the main functional processes specific to transport engineering.	Standard: Optimal solution of complex tasks in the area of transport systems that require a wide range of advanced software applications. Minimum level: Correct solving of complex problems, mainly in the field of transport systems, regarding programming,	Standard: Conceptual and detailed design of optimal, innovative processes, specific to transport systems that meet environmental requirements. Minimum level: Designing details of the basic processes specific to land, sea, and aeronautical engineering	Standard: Elaborating a project based on sustained research, technology optimization and/or technology allocation in relation to the predicted/determined traffic flow needs, according to the environmental requirements. Minimum level:	Standard: Developing a research project based on current global development trends, with a high degree of innovation Minimum level: Develop a research project regarding integrated processes/systems with an innovative degree, adapted to environmental requirements, sustainable development at a global

	problems related to the core engineering disciplines within specific land, sea, and aeronautical engineering tasks.		database management and experimental data processing.	systems that meet the environmental requirements.	Elaborate a research project to optimize a process characteristic of predicted/ determined traffic flow, according to the environmental requirements.	level and integrated with the specific international regulations and norms.
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictible professional tasks under supervision and assistance	Applying the values and ethics of the engineering profession under conditions of autonomy and professional independence.					
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Responsible execution of complex professional tasks under professional independence. Promoting logical, convergent and divergent reasoning, practical applicability, assessment and self-assessment in decision-making. Responsible execution of complex professional tasks.					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions	Performing activities with the exertion of roles specific to teamwork on different hierarchical levels and assuming leadership roles. Promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism, and continually improving their own activities. Communication, teamwork, and leadership.					
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Objective self-evaluation and diagnosis of the need for continuous professional training, for the purpose of insertion into the labor market and adaptation to the dynamics of its requirements, for the personal and professional development. Self-control of learning and efficient use of language skills, knowledge of information technology and communication. Manager of his own continuous training.					
Minimum performance standards for integrated learning outcomes assessment:	Standard: Carrying out research reports and semestrial projects, as well as dissertation papers, in terms of autonomy and professional independence.	Minimum level: Carrying out research reports and half-year projects for land, sea, and aeronautical transport engineering activities as well as dissertation work with research and scientific innovation elements, with the correct use of bibliographic sources, rules, regulations and specific directives, under conditions autonomy and professional independence, as well as their support with the demonstration of qualitative and quantitative evaluation of technical solutions in the field and their own results.	Standard: Creating and conducting complex group projects or projects, identifying and describing professional roles at the team level. Participation in research grants.	Minimum level: Creating and conducting some group work or projects, identifying and adequately describing the professional roles at the team level and respecting the main attributes of teamwork. Participating as a team member in at least one research project	Standard: Identification and diagnosis of the need for professional training, reflective analysis of training, professional development, self-control of learning and efficient use of communication and training resources (Internet, e-mail, databases, on-the-job training), including using foreign languages. Publication of scientific papers.	Minimum level: Identify and diagnose the need for training, with a satisfactory analysis of own training activity, professional development level, self-control of learning and the proper use of communication and training resources (Internet, e-mail, databases, on-line, etc.), including at least one foreign language; publishing at least two articles locally.

9.5.2 Description for Study Programme IT Applied in Aviation

Study Field *ENGINEERING* **Study Programme IT Applied in Aviation**

Grid 1 – *Description of study programme by means of learning outcomes and descriptors*

Qualification Title IT applied in aviation Qualification Level: **7 - MASTER**	Existing and possible occupations • New occupantions proposed to be included in COR: Prerequisites for access: Graduate of the Aerospace Engineering or IT Engineering field Recommended for Bachelor's degree programs: IT applied in aviation					
COMPETENCES **DESCRIPTORS**	Critical analysis, mathematical models in conducting calculations, demonstrations and applications to solve tasks specific to complex, ICT and aeronautical engineering tasks using advanced knowledge from engineering sciences.	Mathematical modeling and optimization of technical processes in general, aeronautical and ICT specifics in particular.	Integrated use of advanced software applications to solve complex tasks predominantly specific to aeronautical activities.	Using programming languages and software implementation of data processing algorithms for conceptual and detailed design of aeronautical, optimized, innovative aeronautical processes, predominantly specific to airports and airlines.	Conceptual and detail design of ICT tools in relation to aeronautical activities development features.	Developing innovative IT products with aerospace applications in relation to the requirements of international organizations by ensuring a high standard of quality, safety and security.
KNOWLEDGE						
1. In-depth knowledge of a specialization area and, within it, of the programme specific theoretical, methodological and practical developments	Identification and detailed description of a wide range of concepts, principles, theorems and methods in the field of aerospace engineering and ICT using specific terms.	Detailed definition and broad description of the theoretical and practical knowledge necessary for the design, analysis and implementation of aeronautical processes using the appropriate ICT tools.	Detailed identification and description of concepts, theories, principles and a wide range of software applications and aeronautical field optimization models.	Identification of a broad spectrum of basic theories, methods, principles, programming languages and software packages for the conceptual and detailed design of aeronautical activities, predominantly specific to ICT applied in air transport.	Identifying a broad spectrum of theories, concepts, methods and principles for conceptual and detail design of ICT engineering and development in airport planning, in optimization of air traffic and airport operations.	Identification and detailed description of a broad spectrum of ICT methods for the sustainable development of aeronautical activities.
2 Use of highly specialized knowledge in order to explain and interpret new situations in wider contexts associated to the respective field	Using the in-depth knowledge of specialized disciplines to explain and interpret new situations in the context of aerospace and ICT engineering.	Using advanced theoretical and practical knowledge to explain and interpret the performances in ICT engineering and development applied in aviation, in line with current requirements and trends in aviation.	Explaining and interpreting with high degree of detail the possibilities of using software applications and optimization models for computer-aided design of products, processes and technologies, in modeling-simulation and in computerized data processing characteristic to airports and airlines.	Using specialized knowledge and computer-aided design software packages to explain and interpret the new challenges and solutions proposed to optimize the performance of aeronautical services.	Use of expertise to explain and interpret new IT technologies used in aviation.	Explaining and interpreting with high degree of detail the methodology of developing IT innovative products in aviation.
SKILLS						

3. Integrated use of the conceptual and methodological apparatus in situation of with incomplete information in order to solve new theoretical and practical problems	Integrated application of a broad spectrum of concepts, principles, theorems and methods from the fundamental engineering disciplines for advanced calculations in the design and operation of aeronautical systems and for solving new theoretical and practical problems	Integrated application of a broad spectrum of methods to optimize IT processes, based on a limited number of segregation factors.	Integrated application of a wide range of software applications and advanced optimization models for programming, simulation, computer-aided design of research projects on various practical issues in the field of airport, air traffic and airlines.	Integrated application of a broad spectrum of principles and methods for conceptual and detailed design of aeronautical programs.	Integrated application of a broad spectrum of principles and methods to identify the means of conceptual and detailed design of new complex technological systems, specific to aerospace engineering.	Integrated application of a broad spectrum of methods for the development of innovative products and for the design, realization and valorisation of the products according to specific regulations at national / international level.
4. Pertinent and appropriate use of qualitative and quantitative assessment criteria and methods to formulate judgements and fundament constructive decisions	Critical, quantitative and qualitative assessment and recommendation of solutions in various applications in the field of aeronautical services.	Evaluate and establish the most appropriate methods to optimize the studied phenomena, establish well-founded criteria for refining solutions and implementing decisions in a constructive sense.	Using relevant process evaluation criteria by various methods for evaluating and selecting software applications for use in experimental testing, modeling and simulating airport operations and processes.	Evaluate and establish optimal ways to ensure a high degree of functionality of airport flow processes in relation to international standards, but also with the needs of aeronautical agents.	Evaluating and establishing optimal variants of complex systems and equipments and means to substantiate safety decisions in relation to international procedures and available resources.	Evaluating and using criteria for analyzing and validating proposed solutions for high complexity issues on optimizing airport operations; and establishing programs on the sustainable development of aeronautical activities in relation to internal/ international regulatory bodies in the aeronautical field.
5. Development of professional and/ or research projects integrating a wide range of methods in different fields in an innovative means.	Developing professional and/ or research models and/or projects using a broad spectrum of theorems, principles and methods of fundamental subjects in the field of aerospace engineering or automatic control and computers.	Elaborating projects based on various methods requiring mathematical-experimental modeling for optimizing technical and economic phenomena, leading to varied solutions which can be applied to the dynamics of the international aviation market.	Elaboration of professional and/or research projects based on various methods using different boundary situations characteristic of integrated aeronautical processes, using a wide range of IT solutions, digital technologies and advanced software tools designed to simulate various scenarios and boundaries.	Development of professional and/or research projects covering a wide range of computer-aided design methods, that meet current challenges in airfield and include innovative processing technologies and systems that respond to current and future air traffic patterns.	Developing professional and/or research projects using a variety of IT solutions to optimize performance, corroborated with national/international regulations and local resources of aeronautical agents involved.	Developing professional and/or applied research projects at airports/airlines or ATC for innovative and successful, high performance IT products, meeting current needs for safety, security, quality and sustainable development.
6. Communication in different contexts / environments, including foreign languages and ICT-mediated, communication adapted to various public	Standard: The optimal solution of a wide spectrum of advanced calculations and complex problems related to the basic automatic control and computers and engineering disciplines, within specific tasks in the aeronautical field. Minimum level: Correct solving of advanced calculations and complex problems related to the core disciplines of automatic control and computers and engineering, within	Standard: Optimizing different types of technical, economic and financial processes based on mathematical modeling. Minimum level: Mathematical modeling of technical and economic processes based on a limited number of factors of influence in the aeronautical field.	Standard: Solving complex ICT problems with limit and procedural situations in the aeronautical field. Designing, simulating, analyzing and validating the hardware and software implementation solutions in the aeronautical field. Minimum level: Correct solving of high complexity problems in the aeronautical field regarding the programming, management and processing of experimental data,	Standard: Designing and analyzing aerospace processes using specific programming languages and computer assisted design software packages. Minimum level: Simulating, analyzing and optimizing the airport processes or details of an airline involved in national/ international traffic.	Standard: Elaboration of a complex IT process for technology optimization and/or technology allocation in relation to the predicted/ determined airport/air traffic flow needs. Minimum level: Detailed design, simulation and performance analysis of aerospace IT equipments or processes characteristic to predicted/ determined airport operations.	Standard: Developing a research project based on current ICT development trends in aviation, with a high degree of innovation Minimum level: Develop a research project of a process /system with an innovative degree at the local level but adapted to the requirements of sustainable development at a global level and integrated with the specific international norms.

	specific tasks in the aeronautical field.		by modeling with different algorithms.			
AUTONOMY AND RESPONSABILITY						
7. Undertaking complex and unpredictible professional tasks under supervision and assistance	Applying the values and ethics of the engineering profession under conditions of autonomy and professional independence.					
8. Assuming responsability to manage and transform work or study context that are complex, predictible, unpredictible and require new strategic approaches.	Responsible execution of complex professional tasks under professional independence. Promoting logical, convergent and divergent reasoning, practical applicability, assessment and self-assessment in decision-making. Responsible execution of complex professional tasks. Critically and independently review and evaluate their own work and that of others; Demonstrate both confidence and effectiveness in: communication and its support through appropriate IT facilities; setting of objectives and the planning and management of time and resources; management and team working skills; approach professional problems and challenges with initiative, responsiveness, decisiveness and confidence.					
SOCIAL AND PERSONAL DEVELOPMENT						
9. Interaction within professional groups or institutions	Performing activities with the exertion of roles specific to teamwork on different hierarchical levels and assuming leadership roles. Promoting the spirit of initiative, dialogue, cooperation, positive attitude and respect for others, diversity and multiculturalism, and continually improving their own activities. Communication, teamwork, and leadership.					
10. Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Objective self-evaluation and diagnosis of the need for continuous professional training, for the purpose of insertion into the labor market and adaptation to the dynamics of its requirements, for the personal and professional development. Self-control of learning and efficient use of language skills, knowledge of information technology and communication. Manager of his own continuous training.					
Minimum performance standards for integrated learning outcomes assessment:	Standard: Carrying out research reports and semestrial projects, as well as dissertation papers, in terms of autonomy and professional independence.	Minimum level: Carrying out research reports and half-year projects for airport and aeronautical business activities as well as dissertation work with research and scientific innovation elements, with the correct use of bibliographic sources, rules, regulations and specific directives, under conditions autonomy and professional independence, as well as their support with the demonstration of qualitative and quantitative evaluation of technical solutions in the field and their own results.	Standard: Creating and conducting complex group projects or projects, identifying and describing professional roles at the team level. Participation in research grants	Minimum level: Creating and conducting some group work or projects, identifying and adequately describing the professional roles at the team level and respecting the main attributes of teamwork. Participating as a team member in at least one research project.	Standard: Identification and diagnosis of the need for professional training, reflective analysis of training, professional development, self-control of learning and efficient use of communication and training resources (Internet, e-mail, databases, on-the-job training) - line, etc.), including using foreign languages (English ICAO). publication of scientific papers.	Minimum level: Identify and diagnose the need for training, with a satisfactory analysis of your own training activity, professional development level, self-control of learning and the proper use of communication and training resources (Internet, e-mail, databases, on-line, etc.), including at least one foreign language (English ICAO); publishing at least two articles locally

10 Comparative Analysis of Qualifications Frameworks

10.1 Two Similar Approaches to Learning Outcomes

Qualifications systems include education and training institutions which are part of the structure of the ministries of education but also training institutions belonging to other national or international structures. An example of the latter would be the air transport sector, a highly regulated sector, including very particular training institutions. This sector comprises a wide diversity of regulated occupations which involve specific training and award of licenses. As a general rule, but especially in aviation training programmes are distinguished by type, level and objectives of training. Hence the need to determine very precisely the learning outcomes and to correlate them between the various training options. Recognition of competences and correlation of learning outcomes may provide support for designing coherent professional pathways and complementarity of general training in the aviation field, provided by high schools or universities and specific training for certain occupations in the sector.

In order to enhance coherence of training in the air transport industry, dialogue between university - trainer within the sector - employer is crucial for the joint development of tools defining learning outcomes for each training level, such as National Qualifications Framework (NQF), Sectoral Qualifications Framework (SQF) or other specific systems such as those used by Eurocontrol, Competence Based Assessment System (CBAS). Therefore we intend to focus on the similarities of the two approaches, NQFHE and CBAS: similarities in structure and descriptors of competences on the one hand and in ways of achieving progression through qualifications levels, on the other hand. This theoretic attempt may be a first step towards highlighting the convergence between the two components, education and training, and it might lead to significant harmonization for the air transport field, a very interesting example due to the international standards and requirements strictly supervised by the International Air Traffic Association (IATA).

10.2 Structure and Descriptors of Competences

10.2.1 National Qualifications Framework for Higher Education (NQFHE) Approach

The development of the *NQFHE* meets both the requirements regarding access, progress in the university career and students' and graduates' mobility in the European Area, as well as needs identified at national level in order to create a coherent structure for the organisation and classification of qualifications, to stimulate the openness of the university training system to the social and economic environment and to ensure the match between education and training demand and supply. Thus, the autonomy and social responsibility of each university are increased.

NQFHE is the instrument for optimising the university curricula, for ensuring readability and convergence of learning outcomes for all levels and types of programmes within the national qualifications system. NQFHE is a catalyst for the implementation of the Bologna process and an essential stage for the European and international recognition of diplomas and qualifications. The *NQFHE has a structure on three levels*: *Bachelor – Master – Doctorate*, and for each levels [10.1] has been developed specific descriptors in order to arrive to a particular grid for each diploma. We present here synthetically the types and descriptors of competences:

- **professional competences** are the integrated and dynamic unit of knowledge and skills:
    - **knowledge,** as cognitive dimension and structural element of the competence, is expressed in terms of the following descriptors:(1) Knowledge, understanding and use of specific language; (2) Explanation and interpretation;
    - **skills**, as functional-actional dimension and structural element of the competence, are expressed in terms of the following descriptors: (3) Application, transfer and problem solving; (4) Critical and constructive reflection; (5) Creative-innovative conduct;

- **transversal competences** are values and attitudes that transcend a certain study programme/field and are expressed in terms of the following descriptors: (6) Autonomy and responsibility; (7) Social interaction; (8) Personal and professional development.

Table 10.1 NQFHE Learning Outcomes

Level	Learning outcomes
Level 6 Bachelor	• advanced knowledge of a field of work or study, involving a critical understanding of theories and principles • advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study • manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts • take responsibility for managing professional development of individuals and groups
Level 7 Master	• highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research • critical awareness of knowledge issues in a field and at the interface between different fields • specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields • manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches • take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams

Level	Learning outcomes
Level 8 Doctorate	• knowledge at the most advanced frontier of a field of work or study and at the interface between fields • the most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice • demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research.

SOURCE

10.2.2 Air Traffic Control Based Assessment System – CBAS Approach

Competence Based Assessment System in air traffic controllers training has been designed as an effort to solve several training issues and is considered as an important contribution to the overall effort to increase the success rate of training of air traffic controllers. The CBAS is expected to improve consistency in assessment by different assessors, transparency to the student and the coach about the expected performance at a certain moment during the training, clearer view of student progress, both for the student and for the trainers.

CBAS is organized *on three levels too: Rating training, Pre OJT (pre on the job training), OJT (on the job training – operation room)*. To perform successfully as Air Traffic Controller (ATCO), a total of fourteen competences are considered to be required (Table 10.2).

Table 10.2 ATCO Competences and Criteria

Competence	Criteria
Safety	▪ Applies separation criteria correctly ▪ Switches in time from monitoring to ensured separation ▪ Builds in safety buffers
Effective traffic handling	▪ Takes into account differences in aircraft performances ▪ Achieves correct exit conditions ▪ Achieves inbound spacing as required ▪ Applies speed control correctly ▪ Applies vectoring technique correctly ▪ Applies Rate of Climb/Rate of Descent correctly
Working management	▪ Adapts workload to the traffic complexity ▪ Manages personal efficiency and work tempo ▪ Remains concentrated with various traffic levels
Situational Awareness	▪ Absorbs information to form an overall picture ▪ Keeps a clear overview of the situation by scanning regularly ▪ Anticipates future traffic situations ▪ Assesses accurately the delegation of responsibility for separation
Planning	▪ Formulates a plan in advanced

Competence	Criteria
	▪ As CC, the trainee identifies conflicts and takes appropriate action in time ▪ Has a variety of possible solutions ▪ Is flexible and adjusts plan when necessary
Decision Making	▪ Makes well timed decisions ▪ Sets priorities correctly ▪ Takes initiative and acts accordingly
Communication	▪ Makes all communications in a clear and concise way ▪ Uses standards phraseology or non-standard phraseology where needed ▪ Monitors the sector frequency and responds to pilots calls or requests in time ▪ Obtains and verifies acknowledgements and read - backs when required
Coordination	▪ Assists effectively by initiating appropriate co-ordinations in time ▪ Ensures proper information flow between EC and CC ▪ Executes hand-over of working position correctly
Emotional control	▪ Shows self-belief and remains confident ▪ Can recover from mistakes ▪ Stays calm under pressure
Attention Management	▪ Performs several actions simultaneously ▪ Memorizes relevant information
Procedures	▪ Knows and applies procedures and working agreements correctly
HMI	▪ Has a good working knowledge of the system ▪ Monitors electronic displays and keeps them updated
Attitude	▪ Shows motivation, responsibility and commitment ▪ Accepts criticism/advice
Team-work	▪ Has the ability to work in a team environment ▪ Shares tasks and supports when needed

SOURCE

Though the identification of common competences/criteria might seem difficult, it is first of all important that there are elements of comparison, such as the structure (three levels), the criteria (learning outcomes – competences, descriptors - criteria). Closer analysis of descriptive elements reveals that “manage complex technical or professional activities or projects” is very similar to “manages personal efficiency and work tempo”; likewise “solve complex and unpredictable problems in a specialised field of work or study” resembles “has a variety of possible solutions and is flexible and adjusts plan when necessary”. The next step to be undertaken by mixed teams (trainer – trainee – employer) will be to find the most adequate wording which will equally meet the standards of stakeholders and will be easy to understand.

10.3 Achieve Progression Trough Qualification Levels

10.3.1 National Qualifications Framework for Higher Education (NQFHE) Approach

The NQFHE matrix includes: qualification levels, learning outcomes expressed in terms of knowledge, skills and competences as well as the level descriptors for qualifications in higher education.

The level descriptors for each type of learning outcomes detail the generic descriptors for each type of competence and for each qualification level: Bachelor, Master's, and Doctorate.

An horizontal analysis presents a generic descriptor against the three university cycles: Bachelor, Master's and Doctorate. In this case, the descriptors highlight the competence development and the increase in the professional qualification level. One can notice that the model targets another type of progress, suggesting an increase in the *added value* for each type of learning outcome with the progress from one university qualification level to another. The horizontal perspective demonstrates that each level of competence related to the three study cycles must integrate the previous levels. In order to be as visible as possible the Romanian Register for Qualifications in Higher Education (www.rncis.ro) has published the descriptor grids for more than 325 diplomas/qualifications at Bachelor level within the HE system. The grids describe a study programme using the matrix descriptors, starting from a set of 4-6 core professional competences and 1-2 core transversal competences, agreed upon by specialists in the field.

Table 10.3 NQFHE Matrix

Competence	Bachelor Level	Master Level	Doctorate Level
Autonomy and responsibility	Responsible performance of professional task in a autonomous manner, with qualified assistance	Undertaking complex professional task under autonomy and professional independence conditions	Innovative initiation and development of complex theoretical and practical projects

10.3.2 Air Traffic Control Based Assessment System – CBAS Approach

For all individual criteria behavioural descriptions have been developed for each level and module. The descriptions specify what behaviour is acceptable at the end of the module or level in order to progress to the next module or level. The behaviour expectations have been developed in such ways that the gradual increase in traffic complexity and increased experience of the student have been considered.

For better understanding, we will present a detailed analysis of the behavioural descriptions for the "Safety competence - Switches in time from monitoring to ensured separation" for each phase: Rating training, Pre OJT, OJT [10.6].

Table 10.4 Rating training behavioural descriptions

Safety	LU1	LU2	LU3	LU4
Switches in time from monitoring to ensured separation	The student is generally able to monitor aircraft and when required, initiate positive action to ensure separation in time.	The EC usually monitors aircraft and when required, initiates positive action to ensure separation in time. The CC usually monitors aircraft on radar and usually acts as required.	The EC monitors aircraft and when requires, initiates positive action to ensure separation in time. The CC monitors aircraft on radar and acts as required. The student might sometimes require support during UDES situations.	The EC monitors aircraft and when required, initiates positive action to ensure separation in time. The CC monitors aircraft on radar and acts as required.

Table 10.5 Pre OJT Training behavioural descriptions

Safety	Module 1	Module 2	Module 3	Module 4
Switches in time from monitoring to ensured separation	During this module the student may still have trouble adapting to the new sector layout and its inherent complexities. He may be late in switching from monitoring to ensured separation because of attention distribution problems.	During this module the student must still determine the correct moment to switch from monitoring to ensured separation. Although he recognizes the need for the switch, for timing, he may still depend on the coach.	During this module the student is able to switch in time from monitoring to ensured separation without prompting from his coach.	During this module the student is able to switch in time from monitoring to ensured separation without prompting from his coach.

Table 10.6 OJT Training behavioural descriptions

Safety	Level 1	Level 2	Level 3	Level 4
Switches in time from monitoring to ensured separation	Distribution of attention during increased traffic is such that some conflicts are not recognized in time. Therefore the trainee is sometimes late to switch from monitoring to positive control action.	The switch from monitoring to a positive control action during low traffic complexity is timely and correct, resulting in a continuous safe control of traffic. During moderate and high traffic complexity the trainee may find it difficult to pay attention to all traffic and apply control actions in time.	The switch from monitoring to a positive control action during low traffic complexity is timely and correct, resulting in a continuous safe control of traffic. During high traffic complexity the trainee may find it difficult to pay attention to all traffic and apply control actions in time.	The switch from monitoring to a positive control action during low traffic complexity is timely and correct, resulting in a continuous safe control of traffic. The trainee is able to pay attention to all traffic and apply control actions in time.

Even brief analysis of a competence development, regardless the one we choose, may it be “Autonomy and responsibility” for the NQFHE approach, or “Safety: Switches in time from monitoring to ensured separation” for the CBAS approach shall lead us to the conclusion that both approaches involve the “Matrioska” principle: each level of competence must integrate the previous level and lead to higher competence, which would indicate the progress and development of trainees from one module to another, and from one level of qualification to another. This approach in the design and understanding of the qualification as a building built by competence bricks, creating trinomial structures such as awareness – self control – development, is common to both approaches and it may be an important advantage for harmonising all types of diplomas and licenses.

11 Conclusions

The air transport industry is crucial for society as one of the main means of meeting the mobility needs of companies and individuals. The industry brings together a variety of activities and offers many different occupations accessible to all qualification levels. More of these occupations require specific competences, certified by authorities in the field and acquired through special training programmes. Such programmes start with an initial training at high school or higher education level and continue throughout the employee’s professional life, according to their position of specific tasks. Due to this specificity, the development of a qualifications framework is vital for the air transport sector. The dialogue between educational or training bodies and the stakeholders of air transport industry as well as the proper implementation of national qualification framework and European Qualification Framework in this sector can be considered as key factors of development better employees for high level jobs.

Air transport industry is also one of the specific domains that kept the attention of the experts which at European level have starting in February 2011 the work of building of a multilingual classification of competences, skills, occupations and qualifications named ESCO [29]. The new tool will reflect that qualifications – or diploma, certificates, award and/or licenses – play a key role in linking the labour market and the education and training system. In some cases, like the Air transport industry for example, a particular qualification is legally and administratively defining as a prerequisite for entering and practicing an occupation. In this case, the particular qualifications can be seen as currency allowing individuals to exchange their education and training experiences into relevant employment. That is why it should be merely important to have a complete and structures overview over different qualifications and moreover over different pathways to achieve a qualification using all your previous education and professional experiences.

11.1 The general context of employment: a strong growth in recruitment needs and a lack of competent profiles

1. *The confirmation of increasing recruitment needs on all the functions in air transport*
    - Recruitment increases significantly for most companies in the air transport sector, both for prime contractors and subcontractors.
    - Recruitment increased significantly in 2017 with prospects until 2030.
    - Recruitment growth, however, is less than growth in turnover due to work to improve organizations and therefore productivity.
    - Recruitment covers all functions, but with a preponderance, in general, on the category “other jobs on airports”.
2. *We have identified skills shortages*

- Companies report strong difficulties in finding qualified professionals with experience in the air transport industry, a criterion that seems particularly important in aeronautics compared to industries, including other transportation activities (naval, rail, automobile).
- In addition, the lack of attractiveness of the technical and even scientific study programmes and of industrial sectors accentuates recruitment tensions.
- Thus, many companies are unable to meet their recruitment needs: recruitment times are particularly long, up to a year to find the right profile and thus, companies ask their teams to increase the number of working hours.
- For example, the main difficulties are reported for professions which require more than one specialisation: software aeronautical architect, computational engineer with aeronautical knowledge, environmental air transport engineer etc.
- There are also classical occupations in aviation for which it is difficult to find people with the adequate qualifications; as for example mechanic for aircraft maintenance and for airline pilots.
- Some companies from air transport industry (Zodiac, Safran, Tiger Aero) have opened new trainings for covering the shortage of qualifications.
- There are many jobs which required interdisciplinary competences and so interdisciplinary qualifications; for this kind of jobs there are not enough study programs, in general for interdisciplinary competences as for example: IT & aviation, economics & aviation, environment & aviation, law & aviation.
- Taking in consideration new jobs, new knowledge and skills must be ensured appropriate curricula and furthermore curricula need to undergo chances on the new aviation work market.

3. *Recruitment levels on most occupations tend to change*
    - The degree levels required for aviation occupations tended to increase, more occupations are regulated or require new skills and knowledge.
    - The increase in the technical nature of the air transport operations will also have an impact on recruitment levels, and thus increase the share of engineers and managers.
    - The changes in the technical nature and approaches in the air transport operations will also have an impact on nature of skills and knowledge; new knowledge and skills are required as for example digital skills, renewable energies, environmental protection etc.
4. *An age pyramid that could in future greatly increase recruitment tensions*
    - Aviation, in general, is characterized by a significant proportion of older workers, as well as a share of young people that has fallen sharply, due to a slowdown in the recruitment of young graduates.

- As a result, this imbalance in the age pyramid will have to be covered when older workers retire. The catch-up phenomenon is going to be multiplied in size, because of the higher needs in recruiting young graduates.

5. *More than one out of two jobs will not be the same in ten years*. The aviation digitalization makes obsolete with a high speed the competences. In most situations, the qualifications have not evolved with the same rhythm needed by enterprises. Automatization and the digital interfaces have been multiplying (as presented in Chapter one), triggering the need of new digital skills however the applicants for the jobs or current employee do not master them. For solving the current situation High institutions or aviation bodies have initiated new interdisciplinary study programs and on job trainings, as for example Japan Airlines (Chapter 7).

11.2 New skills for new occupations, the main challenge for education and training in aviation

As we already presented, digital knowledge and skills are very required in general and, in particular, aviation. CEDEFOP's European skills and jobs (ESJ) survey - The great divide: Digitalisation and digital skill gaps in the EU workforce [16] mentions that the future structural transformation of EU labour markets is tightly knit with a high demand for advanced digital skills. For example, the majority (52%) of adult EU employees stated that a moderate ICT level is required to carry out their job tasks and another 19% require a basic level (Fig. 11.1).

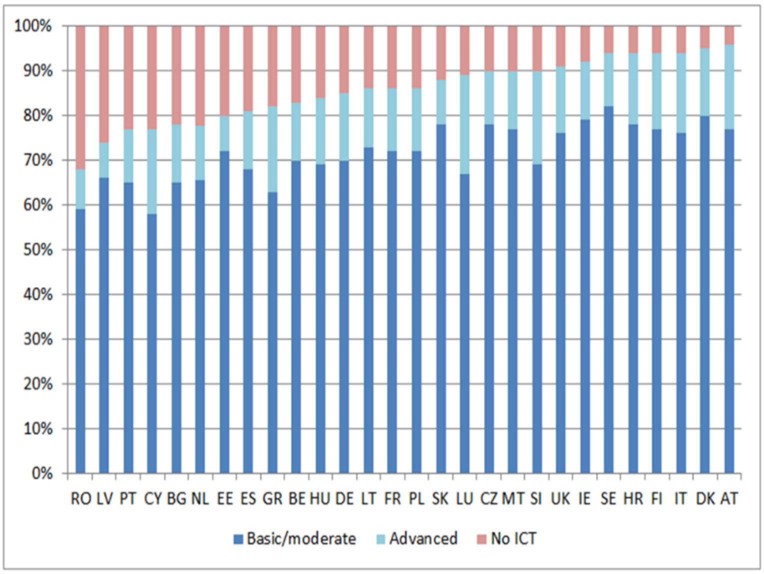

Figure 11.1 Level of ICT skills needed to do the job, adult employees, 2014, EU-28
Source: [16]

Together, more than seven in 10 (71%) EU employees need some fundamental level (i.e. basic or moderate) of digital skills to perform their jobs. About 14% need an advanced ICT level, in contrast to the 14% who stated that they need no ICT skills at all in their jobs. Sweden, Denmark and Ireland are the EU countries in which more than 80% of the adult workforce need at least a fundamental level of ICT skills to do their jobs, in contrast to Cyprus, Romania and Greece where the same holds for about six in 10 workers. Portugal, Bulgaria, Latvia and the Netherlands have the highest share of employees (over a fifth) reporting that their jobs do not need any ICT skills at all.

The checklist below provides a guide for improvement of aviation sectors where high and interdisciplinary qualifications of employees are essential. The implementation of this checklist will require a necessary increase in R&D and technological innovation skills, leadership and concerted, interdisciplinary competences and this requires coordinated actions from public authorities at all levels, together with aviation stakeholders, financial sectors, and international and regional organizations:

- Economic Development Planning – Mainstream the priorities of the aviation sector in States' economic development planning so that aviation can be used as an economic development driver; this requires simultaneously air transport, economic and management competences;
- Air Transport Regulatory Framework – Establish and apply good governance for air transport, i.e. the institutional, regulatory, and policy frameworks, in which air transport is designed, implemented and managed. This field requires simultaneously skills and knowledge in aeronautics, legislation and regulations for air transport;
- Aviation Infrastructure – Develop quality aviation infrastructure (including air navigation systems and airports) commensurate with the level of predicted traffic growth and based on ICAO's global plans; this requires competences in ICT, aviation and smart and green energy solutions.
- Resource Mobilization – Promote diversified funding and financing sources in partnership with States, international and regional organizations, the industry, as well as multi-lateral development banks and other financial institutions. For this field, economic, strategy and aviation knowledge and skills are necessary in the same time
- Safety and Security – Comply with ICAO's global standards and policies, as well as the industry standards to continue enhancing civil aviation safety and security. A strong need for skills related to the "air transport safety process" allowing to design the safety management and review the organization as a whole ensuring safety and security in air transport.
- Environmental Protection – Reinforce efforts toward minimizing the environmental effects from civil aviation activities, especially the achievement of the aspirational goals of carbon neutral growth from 2020. This trend requires informed and engaged employees as crucial participants to advance sustainable air transport solutions.
- Societal responsibility means simultaneously knowledge and skils in society aviation and environment.

For all above mentioned trends, digitalisation is a cross sectorial action which requires advanced skills and competences in ICT and in aviation simultaneously. The new digital technologies applied in aviation ask for all jobs, knowledge of digital tools and skills for their used. Beyond the knowledge of digital tools, the aviation jobs will have to make a rise in skills. Furthermore, new occupations will appear. Some transversal skills and soft skills allowing to evolve in this new digital world become crucial. More than 95% of job offers in the aviation digitalization mention as part of required profile skills that do not fall under technical know-how or knowledge. These skills may be soft skills as creativity, autonomy or transversal skills as management, mastery of foreign languages.

The new skills fit in three major transformations for aviation:

- **technological transformations**: moving from the role of expert to the manager of innovation; the occupation of XXI century will be that of "producer manager" who ensures the production or the functioning of airport or air company, fallows the market trends and he remodels the organization accordingly;
- **organizational evolution**: moving from supervisor to executive manager with a double competence in management: functional and organizational; on airport, the job du XXIth century will be that of manager of the complexity, hierarchical management, functional and multi-local;
- **strategic mutations**: moving from local manager to a multi-local manager for international openness reasons, for the development of global networks or the international mobility; the job of XXIth century will be that of "nomad" engineer or international employee.

The technological revolution in aviation presented in the report and the environmental constraints favour the emergence of new occupations which demand new skills and knowledge, these meaning new qualifications. Our survey on new occupations in air transport indicates that digital skills are crucial for innovation in air transport and for supporting the above-mentioned trend.

The evolution to future aviation, for example airport 4.0, generates the creation of new many jobs. We present some of them resulting from our analysis, which demand interdisciplinary skills and knowledge:

Data Scientist: he/she analyse the data of airport or air company and he/she valorises it; he/she needs skills and knowledge in aviation and IT;

Airport UX Designer: he is a specialist of ergonomy and design who improve the passenger experience; he needs skills and knowledge in ergonomy and design for airports and aircrafts;

Growth Hacker: he/she tracks the information in order to activate new ways of growth on the very competitive aviation market;

Specialist in cybersecurity: he acts for protecting the data of aviation enterprises;

Developer: he is in charge to develop programmes for passengers, also personalised services.

Engineer for AI: he studies the brain functioning and applied it in software development for airports and air companies' processes;

Responsible for Societal Enterprise Responsibility: he is charge with for organise and implement the enterprise strategy for environment, social and economic fields;

Wellbeing officer: he is responsible for the quality of life of employees of air transport enterprises.

- Chief IoT project, he is in charge with the implementation of IoT on airport;
- Data architect
- Responsible with digital data
- Cybersecurity engineer
- Robot technician
- Mechatronic engineer
- Responsible e-CRM (Customer Relationship Management)
- Virtualisation engineer
- Responsible supply-chain.

The new main skills demanded by new occupations are:

- ❖ Technological skills:
    - connectivity,
    - IoT,
    - network,
    - interoperability,
    - security of data,
    - virtual reality,
    - augmented reality,
    - cobotics.
- ❖ Non – technological skills:
    - knowledge management,
    - sharing information,
    - physic ergonomy and cognitive of equipment and infrastructures of aviation,
    - autonomy and responsibility,
    - initiatives and decision making,
    - creativity,
    - project management,
    - system engineering,
    - quality of life at work (wellbeing),
    - social networks.

11.3 Interdisciplinary Master Programme: ICT Applied in Aviation

Nowadays, it is unthinkable to manage a sector as air transport without using ICT technologies. In this sector, we work with complex systems which need specialists who master both informatics and solid knowledge in aviation. The application of IT is crucial for process controlling, for optimization of activities or for the design of new procedures or prototypes, e.g.: ACDM, ATM, SMS, for "digitalization" of airports, for building Airport 4.0. Furthermore, Industrial programmes in Europe like SESAR based on IT deployment in air transport provide another reason to create a new international interdisciplinary Master programme to ensure simultaneously competences in aviation and in ICT.

Unfortunately, IT support of aviation poses a specific challenge: mixed teams of aero specialists and IT experts do not "speak the same language", i.e. they do not share a common expertise. To overcome this difficulty, this initiative envisioned a cross-sectorial master programme common for the two profiles. The innovative feature of the new cross-sectorial master or Bachelor programmes in air transport will consist in new modes of delivery, in particular the integration of a greater variety of study modes: distance, modular learning with adapted curricula, through new forms of personalized learning, strategic use of open educational resources, virtual mobility, European internships with the main air transport employers, blended mobility and virtual learning platforms. Delivery will include lecture, e-learning, on line courses and study cases, airport, airline or systems simulation, on-site visits to air transport and IT industry facilities, and projects completed with industry partners.

The master programme combines profound worldwide experience in international projects and up-to-date ICT technologies and will be organized by modules in order to provide degree options to a wide population which includes the national and international air transportation and IT communities. Due to its modularity, it will allow access, on one hand, to air transport engineers who may choose modules mostly ICT modules and, on another hand, to ICT engineers who may choose modules on air transport. At the end of study programme, all graduates will have in-depth knowledge in applied ICT in air transport.

The master will ensure knowledge and skills for the following jobs: chief IoT project, data architect, responsible with digital data, cybersecurity engineer, virtualisation engineer.

The purpose of this advanced master programme is to provide students with a broad range and depth of interdisciplinary knowledge, ensuring the following learning outcomes:

Knowledge:

- Systems engineering, and applications dedicated to aircraft, air traffic control and air - ground integration, digitalization of airports and better cooperation between aircraft, airports, ATC and airlines through new avionics systems;
- Airport planning, optimization of air traffic and airport operations;
- ICT engineering and development.

Skills:

- Integrate and apply their skills to solve a real engineering problem involving some combination of computational, experimental and theoretical techniques such as: airport master planning and design, airport capacity assessment and optimization, market analysis and aviation demand forecast, simulation software and simulation services; implementation of ITC in airports systems, airliners and in air traffic control;
- Demonstrate ability to deal with complex and contradictory knowledge, critically analysis of complex problems and ability to develop new approaches to problem solving in ICT applied on airports, airlines and ATC;

Attitudes (project management module and internships, all modules):

- Critically and independently review and evaluate their own work and that of others;
- Demonstrate both confidence and effectiveness in:
  - Communication and its support through appropriate IT facilities;
  - Setting objective, and time and resources planning and management;
  - Management and teamwork skills;
- Tackle professional problems and challenges with initiative, responsiveness, decisiveness and confidence.

Learning modes will include lecture, e-learning, on line courses and study cases, airport, airline or systems simulation, on-site visits to air transport and IT industry facilities, internships and projects completed with industry partners.

The optimization and improvement of the overall aviation system generates substantial economic and environmental gains in the face of dramatic traffic growth projections and the pressing need for more determined and effective climate related stewardship. The continued demand for new technology nurtures the development of specialized parts manufacturing clusters worldwide. In turn, the growth of these clusters creates an increasing demand for highly-skilled technicians and designers from local communities. This improves the educational, career and wage prospects of residents, as well as their quality of life.

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Annex 1 - Useful Links

International Organizations

- United Nations Global Compact(http://www.unglobalcompact.org/): a code of conduct for large companies launched by Kofi Annan, the United Nations Secretary General in 2000. The Nine UN' Principles for multinational and transnational companies recognise various forms of human rights, labour/worker rights, and environmental rights.
- United Nations research programme on CSR (http://www.unrisd.org/engindex/research/busrep.htm): a project aiming to promote research and policy dialogue on issues of corporate social and environmental responsibility in developing countries
- ILO Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy (http://www.ilo.org/public/english/employment/multi/tridecl/index.htm)
- ILO database on Business and Social Initiatives (http://oracle02.ilo.org:6060/vpi/vpisearch.first): database on Business and Social Initiatives includes comprehensive information on private sector initiatives, which address labour and social conditions in the workplace and in the community where enterprises operate.
- •OECD Guidelines for Multinational Enterprises (MNEs) (http://www.oecd.org/daf/investment/guidelines/): recommendations to enterprises, made by the Governments of OECD Member countries, as well as Argentina, Brazil and Chile, covering corporate social responsibility issues ranging from employment relations to competition, taxation, and bribery (2000).
- OECD Principles for Corporate Governance (http://www.oecd.org/daf/governance/principles.htm): standards and guidelines for shareholder rights and other governance issues (1999)

UE

- DG Employment and social Affairs webpage on CSR http://europa.eu.int/comm/employment_social/soc-dial/csr/csr_index.htm)
- DG Trade webpage on CSR and OECD Guidelines for multinational enterprises http://www.europa.eu.int/comm/trade/miti/invest/oecd.htm)
- Secretariat General's webpage on Sustainable Development (http://www.europa.int/comm/environment/eussd/index.htm)
- DG Environment webpage containing the 6th Environmental Action Programme of the Community 2001-2010 "Our Future, Our Choice" (http://europa.eu.int/comm.environnement/newprogr/index.htm)
- DG Environment website containing details on the Integrated Product Policy (IPP) (http://europa.eu.int/comm/environment/ipp/home.htm)

- •The International Institute for Sustainable Development (www.iisd.ca), Business and Sustainable Development (BSD) site is a comprehensive source on sustainable development for the private sector.
- Tomorrow: The Sustainable Business Toolkit (www.tomorrow-web.com): contains the latest global business environmental news, links to corporate environmental reports and other information of interest to business.
- Sustainable Business.com (www.sustainablebusiness.com): comprehensive site that contains useful resources for those interested in sustainable business
- The European Authority in aviation safety (https://www.easa.europa.eu/)

5. Legal Framework

Annex III (Part 66) to EU 1321/2014

In accordance with art 67 in EU 2018/1139 (Basic Regulation) “Validity and recognition of certificates and declarations”, certificates issued by the Agency or the national competent authorities shall be valid and recognised in all Member States, without further requirements or evaluation.

Therefore, the Aircraft Maintenance License (Part 66) issued by Romanian Civil Aviation Authority (designated competent authority for civil aviaion in Romania) should be recognised in all Member States, without further requirements or evaluation.

Annex III to EU 1321/2014 (Part 66) contains a detailed presentation regarding the conditions to be achieved in order to obtain Aircraft Maintenance License (Part 66 license).

The AML (together with the certification authorisation issued by the maintenance organisation) allows the holder to certify maintenance work and to release the aircraft to service after maintenance checks.

(a) Aircraft maintenance licences include the following categories:

- Category A
- Category B1
- Category B2
- Category B3
- Category C

(b) Categories A and B1 are subdivided into subcategories relative to combinations of aeroplanes, helicopters, turbine and piston engines. These subcategories are:

- A1 and B1.1 Aeroplanes Turbine
- A2 and B1.2 Aeroplanes Piston
- A3 and B1.3 Helicopters Turbine
- A4 and B1.4 Helicopters Piston

(c) Category B3 is applicable to piston-engine non-pressurised aeroplanes of 2000 kg MTOM and below.

Basic knowledge requirements

An applicant for an aircraft maintenance licence, or the addition of a category or subcategory to such a licence, shall demonstrate by examination a level of knowledge in the appropriate subject modules in accordance with the Appendix I to Annex III (Part-66). The examination shall be conducted either by a training organisation appropriately approved in accordance with Annex IV (Part-147) or by the competent authority.

1. Knowledge levels for Category A, B1, B2, B3 and C Aircraft Maintenance Licence

Regulation (EU) No 1321/2014

Basic knowledge for categories A, B1, B2 and B3 are indicated by knowledge levels (1, 2 or 3) against each applicable subject. Category C applicants shall meet either the category B1 or the category B2 basic knowledge levels.

The knowledge level indicators are defined on 3 levels as follows:

LEVEL 1: A familiarisation with the principal elements of the subject.

Objectives:

(a) The applicant should be familiar with the basic elements of the subject.

(b) The applicant should be able to give a simple description of the whole subject, using common words and examples.

(c) The applicant should be able to use typical terms.

LEVEL 2: A general knowledge of the theoretical and practical aspects of the subject and an ability to apply that knowledge.

Objectives:

(a) The applicant should be able to understand the theoretical fundamentals of the subject.

(b) The applicant should be able to give a general description of the subject using, as appropriate, typical examples.

(c) The applicant should be able to use mathematical formulae in conjunction with physical laws describing the subject.

(d) The applicant should be able to read and understand sketches, drawings and schematics describing the subject.

(e) The applicant should be able to apply his knowledge in a practical manner using detailed procedures.

LEVEL 3: A detailed knowledge of the theoretical and practical aspects of the subject and a capacity to combine and apply the separate elements of knowledge in a logical and comprehensive manner.

Objectives:

(a) The applicant should know the theory of the subject and interrelationships with other subjects.

(b) The applicant should be able to give a detailed description of the subject using theoretical fundamentals and specific examples.

(c) The applicant should understand and be able to use mathematical formulae related to the subject.

(d) The applicant should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject.

The applicant should be able to apply his knowledge in a practical manner using manufacturer's instructions.

(f) The applicant should be able to interpret results from various sources and measurements and apply corrective action where appropriate.

6. Modularisation

Qualification on basic subjects for each aircraft maintenance licence category or subcategory should be in accordance with the following matrix, where applicable subjects are indicated by an 'X':

Subject module	A or B1 aeroplane with:		A or B1 helicopter with:		B2	B3
	Turbin engine(s)	Piston engine(s)	Turbine engine(s)	Piston engine(s)	Avionics	Piston-engine non-pressurised aeroplanes 2000 kg MTOM and below
1 Mathematics	X	X	X	X	X	X
2 Physics	X	X	X	X	X	X
3 Electrical Fundamentals	X	X	X	X	X	X
4 Electronic Fundamentals	X	X	X	X	X	X
5 Digital techniques/ Electronic Instruments System	X	X	X	X	X	X
6 Material and Hardware	X	X	X	X	X	X
7A Maintenance Parctices	X	X	X	X	X	
7B Maintenance Parctices						X
8 Basic	X	X	X	X	X	X

aerodynamics						
9 A Human Factors	X	X	X	X	X	
9B Human Factors						X
10 Aviation Legislation	X	X	X	X	X	X
11A Turbine Aeroplane Aerodynamics, Structures And Systems	X					
11B Turbine Aeroplane Aerodynamics, Structures And Systems		X				
11C Turbine Aeroplane Aerodynamics, Structures And Systems						X
12 Helicopter Aerodynamics, Structures And Systems			X	X		
13 Aircraft Aerodynamics, Structures And Systems					X	
14 Propulsion					X	
15 Gas Turbine Engine	X		X			
16 Piston Engine		X		X		X
17A Propeller	X	X				
17B Propeller						X

Basic experience requirements

An applicant for an aircraft maintenance licence shall have acquired:

1. for category A, subcategories B1.2 and B1.4 and category B3:

i. 3 years of practical maintenance experience on operating aircraft, if the applicant has no previous relevant technical training; or

ii. 2 years of practical maintenance experience on operating aircraft and completion of training considered relevant by the competent authority as a skilled worker, in a technical trade; or

iii. 1 year of practical maintenance experience on operating aircraft and completion of a basic training course approved in accordance with Annex IV (Part-147);

iv. for category B2 and subcategories B1.1 and B1.3:

i. (i) 5 years of practical maintenance experience on operating aircraft if the applicant has no previous relevant technical training; or

ii. (ii) 3 years of practical maintenance experience on operating aircraft and completion of training considered relevant by the competent authority as a skilled worker, in a technical trade; or

iii. (iii) 2 years of practical maintenance experience on operating aircraft and completion of a basic training course approved in accordance with Annex IV (Part-147);

3. for category C with respect to complex motor-powered aircraft:

i. (i) 3 years of experience exercising category B1.1, B1.3 or B2 privileges on complex motor-powered aircraft or as support staff according to point 145.A.35, or, a combination of both; or

(ii) 5 years of experience exercising category B1.2 or B1.4 privileges on complex motor-powered aircraft or as support staff according to point 145.A.35, or a combination of both;

ii. through the academic route: an applicant holding an academic degree in a technical discipline, from a university or other higher educational institution recognised by the competent authority, 3 years of experience working in a civil aircraft maintenance environment on a representative selection of tasks directly associated with aircraft maintenance including 6 months of observation of base maintenance tasks

Endorsement with aircraft ratings

(a) In order to be entitled to exercise certification privileges on a specific aircraft type, the holder of an aircraft maintenance licence need to have his/her licence endorsed with the relevant aircraft ratings.

- For category B1, B2 or C the relevant aircraft ratings are the following:
  1. For group 1 aircraft, the appropriate aircraft type rating.
  2. For group 2 aircraft, the appropriate aircraft type rating, manufacturer sub-group rating or full sub-group rating.

3. For group 3 aircraft, the appropriate aircraft type rating or full group rating.

– For category B3, the relevant rating is ‘piston-engine non-pressurised aeroplanes of 2000 kg MTOM and below’.

– For category A, no rating is required, subject to compliance with the requirements of point 145.A.35 of Annex II (Part-145).

(b) The endorsement of aircraft type ratings requires the satisfactory completion of the relevant category B1, B2 or C aircraft type training.

(c) In addition to the requirement of point (b), the endorsement of the first aircraft type rating within a given category/sub-category requires satisfactory completion of the corresponding On the Job Training, as described in Appendix III to Annex III (Part-66).

Aircraft rating requirements			
Aircraft Groups Group1 - Complex motor- powered aircraft. - Multiple engine helicopters. - Aeroplanes certified above FL290. - Aircraft equipped with fly-by-wire. - Other aircraft when defined by the Agency.	B1/B3 licence (For B1) **Individual TYPE RATING** Type training: - Theory + examination - Practical + assessment **PLUS** OJT (for first aircraft in licence subcategory)	B2 licence **Individual TYPE RATING** Type training: - Theory + examination - Practical + assessment **PLUS** OJT (for first aircraft in licence subcategory)	C licence **Individual TYPE RATING** Type training: - Theory + examination
Group 2 Subgroups: 2a: single turboprop aeroplanes (*) 2b: single turbine engine helicopters (*) 2c: single piston engine helicopters (*) (*) Except those classified in Group 1.	(For B1.1, B1.3, B1.4) **Individual TYPE RATING** (type training + OJT) **or** (type examination + practical experience) **Full SUBGROUP RATING** (type training + OJT) **or** (type examination + practical experience) on at least 3 aircraft representative of that subgroup **Manufacturer SUBGROUP RATING** (type training + OJT) **or** (type examination + practical experience) on at least 2 aircraft representative of that manufacturer subgroup	**Individual TYPE RATING** (type training + OJT) **or** (type examination + practical experience) **Full SUBGROUP RATING** based on demonstration of practical experience **Manufacturer SUBGROUP RATING** based on demonstration of practical experience	**Individual TYPE RATING** type training **or** type examination **Full SUBGROUP RATING** type training **or** type examination on at least 3 aircraft representative of that subgroup **Manufacturer SUBGROUP RATING** type training **or** type examination on at least 2 aircraft representative of that manufacturer subgroup

7. Full Part-66 Licence – Examination Credits Granted By Romanian CAA

All personnel can apply for a Part 66 licence, providing that the practical experience requirements in Part-66 should be achieved either before or after graduating the necessary theoretical exams.

After a standardisation visit performed first by Joint Aviation Authorities in 2002 and reconfirmed by EASA in 2007, Romanian CAA has been allowed to grant credits for some of the modules in Annex I to Annex III (Part 66) to EU 1321/2014 based on a very detailed analysis of the training syllabus of some educational bodies in Romania and a Conversion and Credit Report analysed and approved by EASA.

Based on the educational background, Romanian CAA may grant credits for the modules in Annex I to Part 66. Following a detailed analysis of the Romanian educational system, the general credit system is the following:

Table 11.1 Credit System by Romanian CAA

Basic Theoretic Educational School/Department	Part 66 licence category applied for	Modules covered during school which are credited by RCAA	Modules (exams) which have to be passed
Aerospace Engineering Faculty/ Propulsion/Airframe Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 5, 6, 8	7, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Technical Military Academy Propulsion/Airframe Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 5, 6, 8	7, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Tehnical Military School "Traian Vuia" Propulsion/Airframe Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 5, 6, 8	7, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Aerospace Engineering Faculty IEAB/Avionics Department	B2	1, 2, 3, 4, 5, 6, 8, 13, 14	7, 9, 10
Technical Military Academy IEAB/Avionics Department	B2	1, 2, 3, 4, 5, 6, 8, 13, 14	7, 9, 10
Tehnical Military School "Traian Vuia" IEAB/Avionics Department	B2	1, 2, 3, 4, 5, 6, 8, 13, 14	7, 9, 10
Aircraft Faculty/ IEAB/Avionics Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 5, 8	6, 7, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Technical Military Academy IEAB/Avionics Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 5, 8	6, 7, 9, 10, 11, 12, 15, 16, 17 (depending on the

Basic Theoretic Educational School/Department	Part 66 licence category applied for	Modules covered during school which are credited by RCAA	Modules (exams) which have to be passed
			category applied for)
Tehnical Military School “Traian Vuia” IEAB/Avionics Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 5, 8	6, 7, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Aerospace Engineering Faculty / Propulsion/Airframe Department	B2	1, 2, 3, 4, 6, 8, 14	4, 5, 7, 9, 10, 13
Technical Military Academy Propulsion/Airframe Department	B2	1, 2, 3, 4, 6, 8, 14	4, 5, 7, 9, 10, 13
Tehnical Military School “Traian Vuia” Propulsion/Airframe Department	B2	1, 2, 3, 4, 6, 8, 14	4, 5, 7, 9, 10, 13
Aviation Technical School Propulsion/Airframe Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 6, 8	5, 7, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Aviation Technical School IEAB/Avionics Department	B2	1, 2, 3, 4, 6, 8, 13, 14	5, 7, 9, 10
Aviation Technical School Propulsion/Airframe Department	B2	1, 2, 3, 4, 6, 8, 14	4, 5, 7, 9, 10, 13
Aviation Technical School IEAB/Avionics Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 5, 8	5, 6, 7, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Aviation Vocational School Propulsion/Airframe Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4, 6	5, 7, 8, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Aviation Vocational School IEAB/Avionics Department	B2	1, 2, 3, 4, 6, 13, 14	5, 7, 8, 9, 10
Aviation Vocational School IEAB/Avionics Department	A1, A2, A3, A4, B1.1, B1.2, B1.3, B1.4	1, 2, 3, 4	5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17 (depending on the category applied for)
Aviation Vocational School Propulsion/Airframe Department	B2	1, 2, 3, 4	5, 7, 8, 9, 10, 13, 14

For any other kind of educational background, the credits may be granted only based on a case by case analysis. Romanian CAA will perform a check between the complete training syllabus which has to be submitted by the applicant and the modules in Annex 1 to Part 66.

CONCLUSIONS:

All credits are granted based on a detailed analysis of the syllabus presented to Romanian by the Romanian aeronautical educational bodies 10 years ago (see Annex 2.1).

In order to obtain more credits for the training within schools, Aerospace Engineering Faculty should perform a thorough analysis of the training syllabus in order to update and align it with the requirements in Annex I to Anex III to EU 1321/2014, including the knowledge level.

Annex 2.1 - Syllabus

Notations used in the comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

Abbreviations:

Practical Training - PT

Type Training - TT

Aviation Faculty Syllabus - AFS

Physics (9th-12th grade) - Ph.

Mathematics (till 10th grade) - Math

Personnel categories:

mechanic engineer - m.

avionics engineer - av.

Mechanic engineer graduated "Construction of Structures" or "Propulsion Systems" specialities.

Avionics engineer graduated "Electrical Installations and Instruments" speciality.

Complies with JAR-66:

Y - full compliance

Yp- partial compliance with small differences

N - does not comply with Part -66

In “Observations” column the meaning of:

-Construction of Structures and Propulsion Systems is that personnel with the respective speciality is overqualified for that sub-module;

-TT is that the training was accomplished by Type Training.

MODULE 1. MATHEMATICS – Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
1.1	Arithmetic	2	2	Y	2	NTSg/Math. (till 8th grade)	-----
1.2	Algebra						
a)		2	2	Y	2	NTSg/ Math. (till 8th grade)	-----
b)		1	1	Y	2	NTSg/ Math. (till 10th grade)	-----
1.3	Geometry						
a)		1	1	Y	2	NTSg/ Math. (till 8th grade)	-----
b)		2	2	Y	2	NTSg/ Math. (till 10th grade)	-----
c)		2	2	Y	2	NTSg/ Math. (till 10th grade)	-----

MODULE 2. PHYSICS - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
2.1	Matter	1	1	Y	2	NTSg/Ph.	
2.2	Mechanics						
2.2.1	Statics	2	1	Y	2	NTSg/Ph.	
2.2.2	Kinetics	2	1	Y	2	NTSg/Ph.	
2.2.3	Dynamics						
a)		2	1	Y	2	NTSg/Ph.	
b)		2	2	Y	2	NTSg/Ph.	
2.2.4	Fluid dynamics						
a)		2	2	Y	2	NTSg/Ph.	
b)		2	1	Y	2	NTSg/Ph.	
2.3	Thermodynamics						
a)		2	2	Y	2	NTSg/Ph.	
b)		2	2	Y	2	NTSg/Ph.	
2.4	Optics (Light)	2	2	Y	2	NTSg/Ph.	
2.5	Wave Motion and Sound	2	2	Y	2	NTSg/Ph.	

MODULE 3. ELECTRICAL FUNDAMENTALS - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66		Difficulty level achieved in school		Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2	m.	av.	m.	av.		
3.1	Electron Theory	1	1	Y		2		NTSg/Ph.	
3.2	Static Electricity and Conduction	2	2	Y		2		NTSg/Ph.	
3.3	Electrical Terminology	2	2	Y		2		NTSg/Ph.	
3.4	Generation of Electricity	1	1	Y		1		NTSg/Ph.	
3.5	DC Sources of Electricity	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.6	DC Circuits	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.7	Resistance/Resistor								
a)		2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
b)		1	1	Y		1		NTSg/Ph. + C32, C35 (M4)	
3.8	Power	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.9	Capacitance/Capacitor	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.10	Magnetism								
a)		2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
b)		2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.11	Inductance/Inductor	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.12	DC Motor/Generator Theory	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.13	AC Theory	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	

3.14	Resistive (R), Capacitive (C) and Inductive (L) Circuits	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.15	Transformers	2	2	Y		2		NTSg/Ph. + C32, C35 (M4)	
3.16	Filters	1	1	N	Y	----	1	C32, C35 (M4)	
3.17	AC Generators	2	2	Y		2	2	NTSg/Ph. + C32, C35 (M4)	
3.18	AC Motors	2	2	Y		2	2	NTSg/Ph. + C32, C35 (M4)	

MODULE 4. ELECTRONIC FUNDAMENTALS - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66		Difficulty level achieved in school		Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2	m.	av.	m.	av.		
4.1	Semiconductors								
4.1.1	Diodes								
a)		2	2	Y	Y	2	2	NTSg/Ph.+ C32, C35 (M4)	
b)		---	2	---	Y	---	2	NTSg/Ph.+ C32, C35 (M4)	
4.1.2	Transistors								
a)		1	2	Y	Y	1	2	NTSg/Ph.+ C32, C35 (M4)	
b)		---	2	---	Y	---	2	NTSg/Ph. + C32, C35 (M4)	
4.1.3	Integrated circuits								
a)		1	---	Y	---	1	1	NTSg/Ph.	

b)		---	2	---	Y	---	2	NTSg/Ph. + C7, C32, C35 (M4, M5)	
4.2	Printed Circuit Boards	1	2	Y	Y	1	2	NTSg/Ph. + C7, C32, C35 (M4)	
4.3	Servomechanisms								
a)		1	---	Y	-----	1	-----	C7, C35 (M4, M6)	
b)		---	2	----	Y	----	2	C7, C35 (M4, M6)	

MODULE 5. DIGITAL TECHNIQUES, ELECTRONIC INSTRUMENT SYSTEMS - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66		Difficulty level achieved in school		Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2	m.	av.	m.	av.		
5.1	Electronic Instrument Systems	2	3	Y	Y	2	3	C20, C33, C34 (M5)	
5.2	Numbering Systems	1	2	Y	Y	2	2	NTSg/Math.	
5.3	Data Conversion	1	2	Y	Y	1	2	C6, C28, C68 (M5)	
5.4	Data Buses	2	2	Y	Y	2	2	C6, C28, C68 (M5, M6)	
5.5	Logic Circuits								
a)		2	2	Yp	Y	2	2	C28	
b)		---	2	---	Y	---	2	C28	
5.6	Basic Computer Structure								
a)		2	---	Y	---	2	---	C27	
b)		---	2	----	Y	----	2	C27	
5.7	Microprocessors	---	2	----	Y	----	2	C19	
5.8	Integrated Circuits	---	2	----	Y	----	2	C19	
5.9	Multiplexing	---	2	----	Y	----	2	C19	
5.10	Fiber Optics	1	2	N		----		----	
5.11	Electronic Displays	2	2	Yp	Y	2	2	C20, C30 (M5)	
5.12	Electrostatic Sensitive Devices	2	2	Y		2	2	----	TT

5.13	**Software Management Control**	2	2	Y		2	2	C39	TT
5.14	**Electromagnetic Environment**	2	2	Y		2	2	----	TT
5.15	**Typical Electronic/Digital Aircraft Systems**	2	2	Yp	Y	2	2	C33, C34	TT

MODULE 6. MATERIALS AND HARDWARE - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66		Difficulty level achieved in school		Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2	m.	av.	m.	av.		
6.1	Aircraft Materials - Ferrous								
a)		2	1	Y	Y	2	2	C71 (M10, M23)	
b)		1	1	Y	Y	1	1	C71 (M10, M23)	
6.2	Aircraft Materials - Non-Ferrous								
a)		2	1	Y	Y	2	1	C71 (M10, M23)	
b)		1	1	Y	Y	1	1	C71 (M10, M23)	
6.3	Aircraft Materials - Composite and Non-Metallic								
a)		2	2	Y	Y	2	2	C24, C52 (M10, M22)	
b)		2	---	Y	Y	2	1	C24, C52 (M10, M22)	
6.4	Corrosion								
a)		1	1	Y	Y	1	1	C23 (M10)	
b)		3	2	Y	Y	3	2	C13, C54 (M2, M10)	
6.5	Fasteners								

6.5.1		2	2	Y	Y	2	2	C51, C54 (M1, M2, M9)	
6.5.2		2	2	Y	Y	2	2	C51, C54 (M1, M2, M9)	
6.5.3	Locking devices	2	2	Y	Y	2	2	C51, C54 (M1, M2, M9)	
6.5.4	Aircraft rivets	2	1	Y	Y	2	1	C51, C54 (M1, M2, M9)	
6.6	Pipes and Unions								
a)		2	2	Y	N	2	----	C8 (M2)	
b)		2	1	Y	N	2	---	C8 (M2)	
6.7	Springs	2	1	Y	Y	2	2	C51, C52 (M1, M9)	
6.8	Bearings	2	2	Y	Y	2	2	C1, C74 (M1, M2, M9)	
6.9	Transmissions	2	2	Y	Y	2	2	C51, C74 (M9, M15)	
6.10	Control Cables	2	1	Y	N	2	---	C51, C52 (M16)	
6.11	Electrical Cables and Connectors	2	2	Yp	Y	2	2	C49 (M16)	

There are missing the following subjects:
6.11 High tension and co-axial cables; Crimping;

MODULE 7. MAINTENANCE PRACTICES - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66		Difficulty level achieved in school		Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2	m.	av.	m.	av.		
7.1	Safety Precautions - Aircraft and Workshop	3	3	Y	Y	3	3	C51, C54+PT (M9)	
7.2	Workshop Practices	3	3	Y	Y	3	3	C51, C54+PT (M2, M31)	
7.3	Tools	3	3	Y	Y	3	3	C51, C54+PT (M2, M14)	
7.4	Avionics General Test Equipment	2	3	Y	Y	2	3	C19, C34+PT	TT
7.5	Engineering Drawings, Diagrams and Standards	2	2	Y	Y	2	2	C26, C29+PT (M37)	TT
7.6	Fits and Clearances	2	1	Y	Y	2	1	C54+PT(M2, M9, M31)	
7.7	Electrical Cables and Connectors	2	2	Yp	Y	2	2	C15, C49 (M2)	TT
7.8	Riveting	2	---	Y	----	2	----	C74 +PT (M2)	
7.9	Pipes and Hoses	2	---	Y	----	2	----	C8, C74+PT (M2)	
7.10	Springs	2	---	Y	----	2	----	C74+PT (M2)	
7.11	Bearings	2	---	Y	----	2	-----	C1, C74+PT (M9, M15, M38)	
7.12	Transmissions	2	---	Y	----	2	-----	C74+PT (M9, M15)	
7.13	Control Cables	2	---	Y	----	2	----	C15+PT (M16)	
7.14	Sheet Metal Work	2	---	Y	----	2	----	C13, C14, C15+PT (M2, M31)	
7.15	Welding, Brazing, Soldering and Bonding								
a)		2	2	Y	Y	2	2	C13, C14, C54+PT (M9, M31)	

b)		2	---	Y	----	2	----	C13, C14, C54+PT (M9, M31)	
7.16	Aircraft Weight and Balance								
a)		2	2	Y		2		C10, C54+PT (M17, M32)	
b)		2	---	Y		2		C10, C54+PT (M17, M32)	
7.17	Aircraft Handling and Storage	2	2	Y		-----		----	TT
7.18	Disassembly, Inspection, Repair and Assembly Techniques								
a)		3	2	Y	N	3	----	C54, C74+PT (M2, M10)	
b)		2	---	Y	----	2	----	C54, C74+PT (M2, M10)	
c)		2	1	Yp	N	2	-----	C54, C74+PT (M2, M10)	
d)		2	2	Y	N	2	-----	C54, C74+PT (M2, M10)	
e)		2	2	Y	N	2	----	C54, C74+PT (M2, M10)	

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66		Difficulty level achieved in school		Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2	m.	av.	m.	av.		
7.19	Abnormal Events								
	a)	2	2	Y		Y		-----	TT
	b)	2	---	Y		Y		-----	TT
7.20	Maintenance Procedures	2	2	Y		Y		-----	TT

There are missing the following subjects:

7.18. c) Boroscope methods

MODULE 8. BASIC AERODYNAMICS - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
8.1	Physics of the Atmosphere	2	2	Y	2	C42, C75 (M11, M34)	
8.2	Aerodynamics	2	2	Y	2	C36, C42 (M11)	
8.3	Theory of Flight	2	2	Y	2	C11, C42 (M30)	
8.4	Flight stability and Dynamics	2	2	Y	2	C4, C38, C44, C70 (M18)	

MODULE 9. HUMAN FACTORS - Comparative analysis between Aerospace Engineering Faculty s and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
9.1	General	2	2	NO	-----	-----	
9.2	Human Performance and Limitations	2	2	NO	-----	-----	
9.3	Social Psychology	1	1	NO	-----	-----	
9.4	Factors Affecting Performance	2	2	NO	-----	-----	
9.5	Physical Environment	1	1	NO	-----	-----	
9.6	Tasks	1	1	NO	-----	-----	
9.7	Communication	2	2	NO	-----	-----	
9.8	Human Error	2	2	NO	-----	-----	
9.9	Hazards in the Workplace	2	2	NO	-----	-----	

MODULE 10. AVIATION LEGISLATION - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
10.1	Regulatory Framework	1	1	NO			
10.2	JAR-66 - Certifying Staff - Maintenance	2	2	NO			
10.3	JAR-145 - Approved Maintenance Organizations	2	2	NO			
10.4	JAR-OPS - Commercial air Transportation						
a)	General	1	1	NO			
b)	Subpart M	2	2	NO			
10.5	Aircraft Certification						
a)	General	1	1	NO			
b)	Documents	2	2	NO			
10.6	JAR-Maintenance (when adopt.)	2	2	NO			
10.7	Applicable National and Intentional Requirements for						
a)		2	2	NO			
b)		1	1	NO			

MODULE 11. AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
11.1	Theory of Flight						
11.1.1	Aeroplane Aerodynamics and Flight Controls	2	---	Y	3	C4, C38, C42 (M19, M30)	
11.1.2	High Speed Flight	2	---	Y	3	C4, C38, C42 (M30)	
11.2	Airframe Structures - General Concepts						
a)		2	---	Y	3	C9, C10, C12, C13 (M29,M32)	Construction of Structures
b)		2	---	Y	3	C9, C10, C12, C13 (M29,M32)	Construction of Structures
11.3	Airframe Structures - aeroplanes						
11.3.1	Fuselage (ATA 52/53/56)	2	---	Y	3	C9, C10, C12, C13 (M17,M33)	Construction of Structures
11.3.2	Wings (ATA 57)	2	---	Y	3	C9, C10, C12, C13 (M17,M33)	Construction of Structures
11.3.3	Stabilisers (ATA 55)	2	---	Y	3	C9, C10, C12, C13 (M17,M33)	Construction of Structures
11.3.4	Flight Control Surfaces (ATA 55/57)	2	---	Y	3	C9, C10, C12, C13 (M17,M33)	Construction of Structures
11.3.5	Nacelles/Pylons (ATA 54)	2	---	Y	2	C9, C10, C12, C13 (M17)	
11.4	Air Conditioning and Cabin Pressurisation (ATA 21)						
11.4.1	Air supply	2	---	Y	2	C8 (M17)	

11.4.2	**Air conditioning**	**3**	**---**	**Y**	**3**	**C8 (M17)**	
11.4.3	**Pressurisation**	**3**	**---**	**Y**	**3**	**C8 (M17)**	
11.4.4	**Safety and warning devices**	**3**	**---**	**Y**	**3**	**C16, C17 (M17)**	
11.5	**Instruments/Avionic Systems**						
11.5.1	**Instrument Systems (ATA 31)**	**2**	**---**	**Y**	**2**	**C20, C48 (M5)**	
11.5.2	**Avionic Systems**	**1**	**---**	**Y**	**1**	**C20, C48 (M5)**	
11.6	**Electrical Power (ATA 24)**	**3**	**---**	**Y**	**3**	**C7, C32, C35 (M4)**	
11.7	**Equipment and Furnishings (ATA 25)**						
a)		**2**	**---**	**Y**	**2**	**C20, C67 (M16)**	
b)		**1**	**---**	**Y**	**1**	**C20, C58 (M16)**	

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
11.8	Fire Protection (ATA 26)	3	---	Y	3	C7, C16 (M5)	TT
11.9	Flight Controls (ATA 27)	3	---	Y	3	C10, C41 (M11)	
11.10	Fuel Systems (ATA 28)	3	---	Y	3	C75 (M16)	
11.11	Hydraulic Power (ATA 29)	3	---	Y	3	C8 (M16, M27)	
11.12	Ice and Rain Protection (ATA 30)	3	---	Y	3	C7, C8, C20 (M16)	TT
11.13	Landing Gear (ATA 32)	3	---	Y	3	C10 (M17)	
11.14	Lights (ATA 33)	3	---	Y	3	---- (M19)	TT
11.15	Oxygen (ATA 35)	3	---	Y	3	----	TT
11.16	Pneumatic/Vacuum (ATA 36)	3	---	Y	3	C8 (M16, M35)	TT
11.17	Water/Waste (ATA 38)	3	---	Y	3	C8 (M16)	
11.18	On Board Maintenance Systems (ATA 45)	2	---	Y	2	----	TT

MODULE 12. HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS - Comparative analysis between Aerospace Engineering Faculty y syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
12.1	Theory of Flight - Rotary Wing Aerodynamics	2	---	Y	2	C4, C42, C46 (M7, M20, M25)	
12.2	Flight Control Systems	3	---	Y	3	C4, C42, C46 (M20, M25)	
12.3	Blade Tracking and Vibration Analysis	3	---	Y	3	C3, C46	
12.4	Transmissions	3	---	Y	3	C46, C74 (M40)	
12.5	Airframe Structures						
a)		2	---	Y	3	C9, C10, C12, C13 (M17,M32)	Construction of Structures
b)		2	---	Y	3	C9, C10, C12, C13 (M17,M32)	Construction of Structures
12.6	Air Conditioning (ATA 21)						
12.6.1	Air supply	2	---	Y	2	C8 (M16)	
12.6.2	Air Conditioning	3	---	Y	3	C8 (M16)	
12.7	Instruments/Avionic Systems						
12.7.1	Instrument systems (ATA 31)	2	---	Y	2	C20, C48 (M5, M40)	
12.7.2	Avionic Systems	1	---	Y	1	C20, C48 (M5)	
12.8	Electrical Power (ATA 24)	3	---	Y	3	C7, C32, C35 (M4)	
12.9	Equipment and Furnishings (ATA 25)						

a)		2	---	Y	2	C20, C67	
b)		1	---	Y	1	C20	TT
12.10	Fire Protection (ATA 26)	3	---	Y	3	C7, C16	TT
12.11	Fuel Systems (ATA 28)	3	---	Y	3	C75 (M16)	
12.12	Hydraulic Power (ATA 29)	3	---	Y	3	C8 (M16, M27)	
12.13	Ice and Rain Protection (ATA 30)	3	---	Y	3		TT
12.14	Landing Gear (ATA 32)	3	---	Y	3	C10, C46 (M40)	
12.15	Lights (ATA 33)	3	---	Y	3		TT
12.16	Pneumatic/Vacuum (ATA 36)	3	---	Y	3	C8 (M16)	

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS - Comparative analysis between faculty Aerospace Engineering Faculty and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
13.1	Theory of Flight						
a)	Aeroplane Aerodynamics and Flight Controls	---	1	Y	1	C38, C42 (M19, M30)	
b)	High Speed Flight	---	1	Y	1	C38, C42 (M30)	
c)	Rotary wing Aerodynamics	---	1	Y	1	C42 (M25)	
13.2	Structures - General Concepts						
a)		---	1	Y	1	C12 (M29, M32)	
b)		---	2	Y	2	C12 (M29, M32)	
13.3	Autoflight (ATA 22)	---	3	Y	3	C16, C18, C33, C68 (M3,M21)	TT
13.4	Communication/Navigation (ATA 23/34)	---	3	Y	3	C20, C30, C39, C65 (M5,M19)	TT
13.5	Electrical Power (ATA 24)	---	3	Y	3	C7, C32, C35 (M4)	
13.6	Equipment and Furnishings (ATA 25)	---	3	Y	3	C20 (M16)	TT
13.7	Flight controls (ATA 27)						
a)		---	1	Y	1	C10, C12 (M17)	
b)		---	2	Y	2	C10, C12 (M17)	
13.8	Instrument Systems (ATA 31)	---	2	Y	2	C6, C40, C48, C49, C77 (M5)	
13.9	Lights(ATA 33)	---	3	Y	3	----- (M19)	TT
13.10	On Board Maintenance Systems (ATA 45)	---	2	Y	2	C40	TT

MODULE 14. PROPULSION - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
14.1	Turbine Engines						
a)		---	1	Y	1	C66, C75 (M34)	
b)		---	2	Y	2	----	TT
14.2	Engine Indicating Systems	---	2	Y	2	C48, C49 (M5)	

MODULE 15. GAS TURBINE ENGINE - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
15.1	Fundamentals	2	---	Y	3	C3, C66 (M34)	
15.2	Energy Performance	2	---	Y	3	C2, C22, C25, C45, C66, C72 (M24, M35, M39)	
15.3	Inlet	2	---	Y	3	C2, C22, C25, C44, C45, C66 (M24, M35, M39)	
15.4	Compressors	2	---	Y	3	C22, C25, C45, C66, C72 (M35, M36)	Propulsion Systems
15.5	Combustion Section	2	---	Y	3	C21, C22, C25, C45, C66, C72 (M35, M39)	
15.6	Turbine Section	2	---	Y	3	C22, C25, C45, C66, C72 (M35, M36, M39)	
15.7	Exaust	2	---	Y	3	C22, C25, C44, C45, C66, C72 (M24, M35, M39)	
15.8	Bearings and Seals	2	---	Y	3	C74 (M24, M39)	
15.9	Lubricants and Fuels	2	---	Y	2	C21, C23 (M12, M41)	
15.10	Lubrication systems	2	---	Y	2	C75 (M12, M41)	
15.11	Fuel systems	2	---	Y	2	C75 (M41)	TT
15.12	Air systems	2	---	Y	3	C22, C25, C66 (M35)	
15.13	Starting and Ignition Systems	2	---	Y	2	C22, C25, C66 (M35)	
15.14	Engine Indication Systems	2	---	Y	2	C17 (M5)	
15.15	Power Augmentation Systems	1	---	Y	1	C22, C75 (M34, M35)	

15.16	**Turbo-prop Engines**	**2**	**---**	**Y**	**3**	**C3, C25 (M34, M35, M39)**	
15.17	**Turbo-shaft Engines**	**2**	**---**	**Y**	**3**	**C3, C46 (M34, M39)**	
15.18	**Auxiliary Power Units (APUs)**	**2**	**---**	**Y**	**2**	**C44, C66**	
15.19	**Powerplant Installation**	**2**	**---**	**Y**	**2**	**C1, C75 (M34)**	
15.20	**Fire Protection Systems**	**2**	**---**	**Y**	**2**	**C74**	
15.21	**Engine Monitoring and Ground Operation**	**3**	**---**	**Y**	**3**	**----**	**TT**
15.22	**Engine Storage and Preservation**	**2**	**---**	**Y**	**2**	**----**	**TT**

There are missing the following subjects:

15.4. For Construction of Structures- Fan balancing;

MODULE 16. PISTON ENGINE - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
16.1	Fundamentals	2	---	Y	2	C61 (M28, M43)	
16.2	Engine Performance	2	---	Y	3	C61 (M28, M43)	
16.3	Engine Construction	2	---	Y	3	C61 (M28, M43)	
16.4	Engine Fuel Systems						
16.4.1	Carburettors	2	---	Y	3	C61 (M28, M43)	Propulsion Systems
16.4.2	Fuel injection systems	2	---	Y	3	C61 (M28, M43)	Propulsion Systems
16.5	Starting and Ignition Systems	2	---	Y	3	C61 (M28, M42, M43)	Propulsion Systems
16.6	Induction, Exhaust and Cooling Systems	2	---	Y	3	C61 (M28, M43)	Propulsion Systems
16.7	Supercharging/Turbocharging	2	---	Y	3	C61, C75 (M28, M43)	Propulsion Systems
16.8	Lubricants and Fuels	2	---	Y	2	C21, C23 (M12)	
16.9	Lubrication Systems	2	---	Y	3	C75 (M12, M41)	Propulsion Systems
16.10	Engine Indication Systems	2	---	Y	3	C17 (M5)	Propulsion Systems
16.11	Powerplant Installation	2	---	Y	3	C75 (M28, M43)	Propulsion Systems
16.12	Engine Monitoring and ground Operation	3	---	Y	3	----	TT
16.13	Engine Storage and Preservation	2	---	Y	3	----	TT

MODULE 17. PROPELLER - Comparative analysis between Aerospace Engineering Faculty syllabus and provisions in Annex I to Annex III to EU 1321/2014

No.	Subject	Difficulty level required by Annex I to Part 66		Complies with Part-66	Difficulty level achieved in school	Justification of compliance with provisions in Annex I to Annex III to EU 1321/2014 (see page 21-22)	Observations
		B1	B2				
17.1	Fundamentals	2	---	Y	3	C42, C76 (M8)	
17.2	Propeller Construction	2	---	Y	2	C42, C76 (M13, M26)	
17.3	Propeller Pitch Control	2	---	Y	2	C42, C76 (M8, M26)	
17.4	Propeller Synchronising	2	---	Y	2	C42, C76	
17.5	Propeller Ice Protection	2	---	Y	2	C7, C8	
17.6	Propeller Maintenance	3	---	Y	3	----	TT

Support training courses analysed to justify compliance with provisions in Annex I to Annex III (Part 66) to EU 1321/2014

COURSES FROM AVIATION FACULTY SYLLABUS

C1. Additional course for material technology in propulsion systems
C2. Additional course for processes and characteristic in reaction engines
C3. Additional course for reaction engines computations and rotors dynamics
C4. Aeroelasticity and dynamics for aircraft structures
C5. Air legislation
C6. Airborne computers
C7. Airborne electrical systems and actuations
C8. Airborne hidro-pneumatic equipment
C9. Aircraft design complements
C10. Aircraft manufacturing
C11. Aircraft mechanics
C12. Aircraft structures design and computing
C13. Aircraft structures maintenance and repair
C14. Aircraft structures testing
C15. Airspace vehicles manufacturing technology
C16. Automatic aircraft control
C17. Automatics for aviation engines
C18. Autopilots manufacturing
C19. Aviation electronics complements
C20. Avionics, cockpit installations and air navigation
C21. Burning theory for aviation engines
C22. Characteristics and processes of the reaction engines
C23. Chemistry
C24. Composite aircraft materials chemistry
C25. Computation and manufacture of reaction engines
C26. Computer aided design for aircraft construction
C27. Computer programming
C28. Data identification and processing techniques
C29. Descriptive geometry and drawing
C30. Digital communications
C31. Economical analysis and marketing
C32. Electrical convertors for aviation
C33. Electronics and automatisation in aviation
C34. Electronics for aviation
C35. Electrotechnics and electrical machines
C36. Experimental aerodynamics
C37. Flight safety and air traffic control
C38. Flight dynamics
C39. Flight management systems
C40. Flight recorders
C41. Flight simulators
C42. Fluids mechanics and aerodynamics
C43. Foreign languages
C44. Gases dynamics and aerothermochemistry
C45. Heat and mass transfer
C46. Helicopters
C47. Industrial management
C48. Instruments design and computing
C49. Instruments technologies
C50. Linear algebra and differential geometry

C51. Machines devices and mechanisms
C52. Materials for aircraft constructions
C53. Materials resistance
C54. Materials technology
C55. Mathematics analysis and special mathematics
C56. Mechanics
C57. Numerical computation methods in aviation
C58. Operations and infrastructure
C59. Philosophy
C60. Physics
C61. Piston engines for aviation
C62. Political economy
C63. Production activity
C64. Quality assurance
C65. Radio navigation systems
C66. Reaction engines design
C67. Rescue systems
C68. Signals processing in aviation
C69. Sports
C70. Stability and dynamics for airspace vehicles
C71. Study of metals
C72. Technical thermodynamics
C73. Technological practice
C74. Technologies and specific materials for reaction engines manufacturing
C75. Theory and manufacturing of the propulsion systems
C76. Tractive and eolian propellers
C77. Unconventional gyroscopic equipment

Additional bibliography analysed to justify compliance with provisions in Annex I to Annex III (Part 66) to EU 1321/2014:

M1. ******** : "Machine Parts - Collection of Standards (STAS).

M2. ******** : "Mechanical Engineer Manual", Publisher "Editura Tehnica".

M3. ARON I.: " Electrical Gyro Engines and Unconventional Gyroscopes", Publisher "Editura Tehnica", 1986.

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M7. BRAMWELL A.R.S.: "Helicopter Dynamics", Publisher "Unwin Broth. London".

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M15. FILIPOIU I.D.: "Mechanical Drives - Design Guide", Bucharest Politechnical University.

M16. GAVRILIU A. & col.: "Modern Transport Airplane and Airborne Systems", Publisher "Editura Tehnica", 1983.

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Annex 3 - Questionnaire Proposal

Background and employment (Q1-Q8)

Q1: How old are you?

Q2: What is your gender?

Q3: In what country do you work?

Q4: Which aviation sector do you currently work in?

Q5: How long have you been working in your current position?

Q6: What do you like the most about your job?

Q7: What do you like the least about your job?

Q8: Are you currently enrolled as a student (alongside your employment)?

Education and training (Q9-Q18)

Q9: What is the highest level of education you have completed or the highest degree you have received?

Q10: Which of the following best describes the field in which you received your highest educational qualification?

Q11: How relevant were the competences acquired during your education to your first role in the aviation sector?

Q12: Apart from your main educational qualification, what other specific or specialized certification / accreditation have you acquired, if any?

Q13: How helpful was the initial training you received from the organization you work for when you started your job?

Q14: How often do you receive training in the organization you work for?

Q15: I am satisfied with the investment the organization I work for makes in training and education.

Q16: In your opinion, who should be responsible for providing training in the following competence areas?

Q17: If you could choose, what new training courses or topics would you consider valuable / essential for your current occupation?

Q18: Do you have a preference for how training should be delivered?

Collaboration with educational institutions and training providers (Q19 – Q23).

Q19: To the extent of your knowledge, who are the main training providers at the organization you work for?

Q20: To the extent of your knowledge, does the organization you work for collaborate with any higher education institutions?

Q21: Are the representatives of educational bodies in the organization your work for (e.g. in an HR or training department, or in the board of directors) in order to ensure the match between the competences and the requirement of the aviation industry?

Q22: If so, in what way does the organization you work for collaborate with educational institutions?

Q23: Overall, how effective do you think educational institutions are in preparing students for the requirements of their future occupations in the aviation sector?

Key competences (Q24 – Q28).

Q24: Out of the following competences, how important do you feel they are for your current occupation with in the aviation sector?

Q25: In the past 5 years, has the importance of these competences stayed the same, increased or decreased?

Q26: In the next 10 years, do you think the importance of these competences will stay the same, increase or decrease?

Q27: Please list any other competences that you consider essential for your occupation.

Q28: How effectively do you feel your skills are applied in your current occupation?

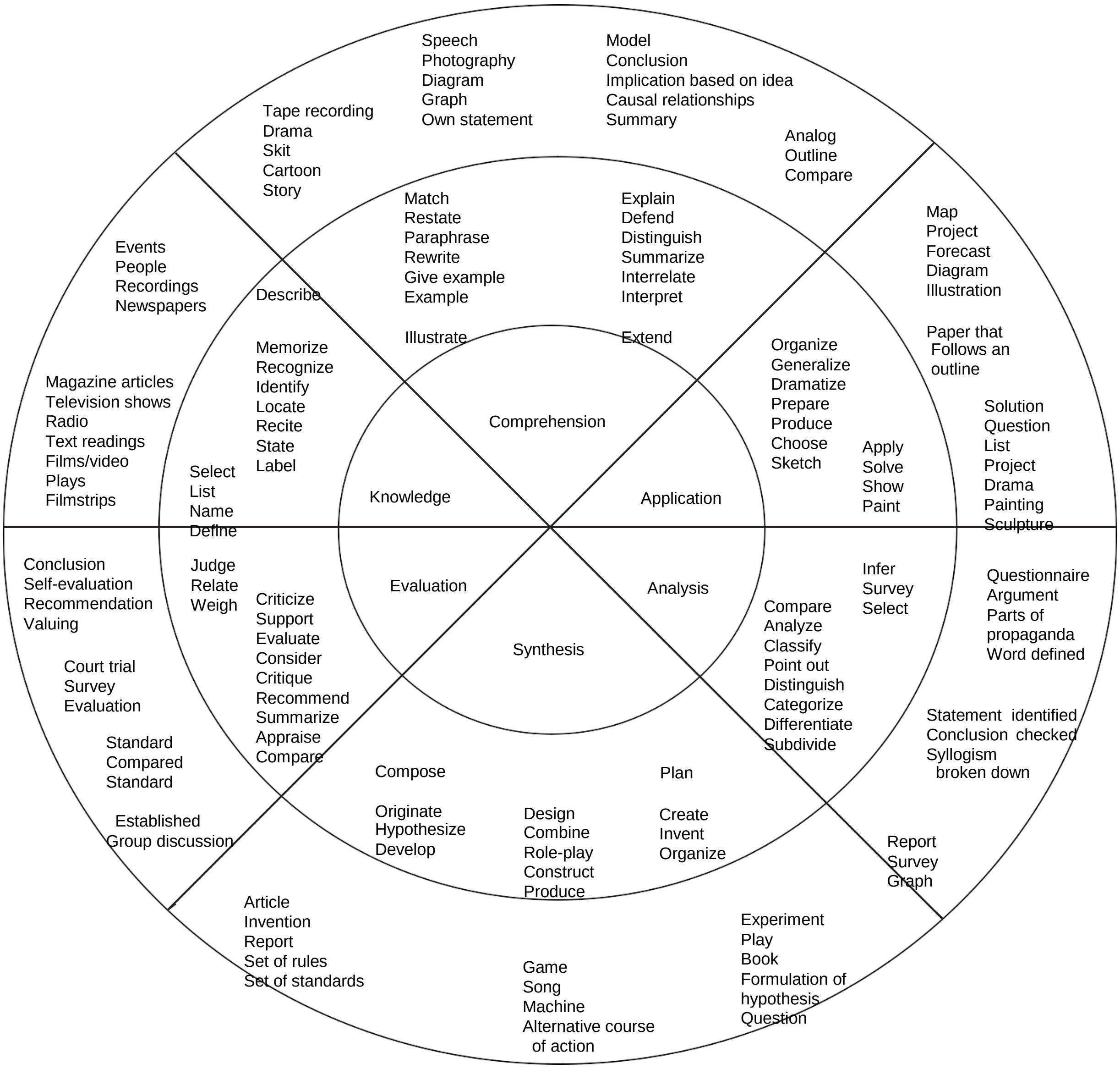
New and emerging occupations (Q29 – Q31)

Q29: In your opinion, to what degree will the following changes and key technologies affect your current occupation in the aviation sector?

Q30: Which occupations do you think are going to drastically change or disappear by 2030?

Q31: What new occupations do you expect will be created in the organization your work for in the next 10 years?

Bloom's Verbs
And Matching Assessment Types



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