Science, Technology and Innovation
ISSN 2544-9125 ▪ 2025; 21 (2): 45–50
doi: 10.55225/sti.657

STI • 2025; 21 (2): 45-50

Integration of academic and European Union aviation safety agency professional requirements

Ibrahims Arandas[1 A-G], Asnāte Venckava[1 E-G], Kirils Kļepackis[2 B,D-G]

[1] Riga Aeronautical Institute, Riga, 9, Mezhkalna str., Riga, LV-1058, Latvia
[2] Riga Technical University, 6A Kipsalas Street, Riga LV-1048, Latvia

Original article

Abstract

Over the next twenty years, the demand for qualified aviation personnel will need to be aligned with aircraft delivery plans. However, there is a growing tendency for students to prefer higher education over professional training, as an academic degree is often perceived as necessary for career advancement; yet professional training remains essential for becoming certified aviation personnel, such as licensed mechanics or avionics specialists. In this article, the authors propose a combined aviation training approach that enables trainees to obtain both a bachelor's degree accredited by the national Ministry of Higher Education and the professional qualifications required by the European Union Aviation Safety Agency (EASA). The analysis of academic and professional programs presented by the authors can be used by the National Aviation Authority (NAA) to award examination credits, in accordance with EASA regulations, to graduates of higher education institutions.

Keywords

- qualified aviation personnel
- higher and professional education
- examination credit
- aircraft maintenance licence
- EASA Part-66
- harmonize training regulations

Authors contributions

A – Preparation of the research project
B – Assembly of data for the research undertaken
C – Conducting of statistical analysis
D – Interpretation of results
E – Manuscript preparation
F – Literature review
G – Revising the manuscript

Corresponding author

Ibrahims Arandas
e-mail: i.arandas@rai.lv
Riga Aeronautical Institute
Riga, 9, Mezhkalna str.
Riga, LV-1058, Latvia

Article info

Article history

- Received: 2025-07-29
- Accepted: 2025-10-09
- Published: 2025-11-28

Publisher

University of Applied Sciences in Tarnow
ul. Mickiewicza 8, 33-100 Tarnow, Poland

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Financing

This research did not receive any grants from public, commercial or non-profit organizations.

Conflict of interest

None declared.

Introduction

Studies on licensed personnel and training capacity show that over the past decade, commercial air transport has experienced strong traffic growth, leading to the emergence of many new operators and resulting in the highest number of aircraft orders ever recorded. Over the next twenty years, the demand for qualified aviation personnel will need to be aligned with aircraft delivery plans. Global and regional twenty-year forecasts for pilots, aircraft maintenance personnel, and air traffic controllers (Doc 9956) [1] compare the number of new personnel required annually with the annual training capacities of existing training infrastructure, with the aim of identifying potential shortages or surpluses worldwide and by region. An example of such a comparison is presented in Figure 1 [2].

Failure to quantify these shortages or surpluses could not only constrain air traffic growth but also negatively affect the safety and efficiency of air transport operations. The challenge for the industry remains to ensure adequate training capacity without compromising quality or safety standards.

According to the Pilot and Technician Outlook 2024–2043, supporting growth driven by the expansion of global fleets will require a long-term strategy that addresses emerging workforce challenges. Investment in early career-development programs and outreach initiatives that inspire future aviators will be essential to maintaining a healthy aviation sector. Long-term demand for newly qualified personnel remains strong, with an estimated need for 674,000 new pilots, 716,000 new maintenance technicians, and 980,000 new cabin crew members to operate and maintain the global commercial fleet over the next twenty years [3].

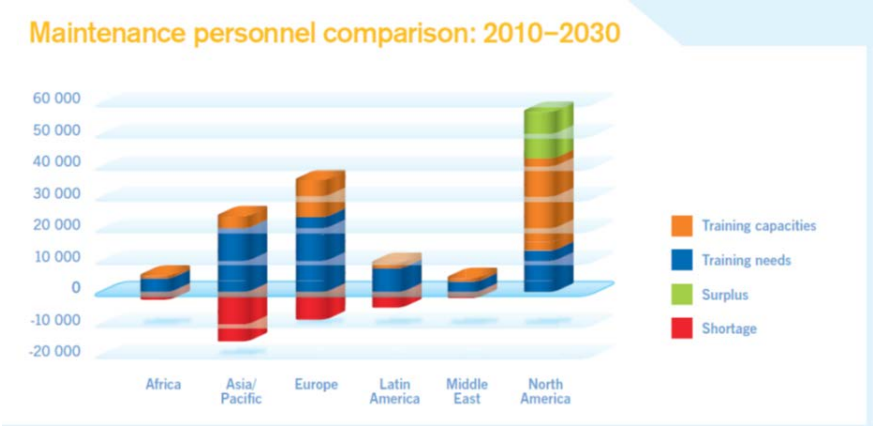

Figure 1. Maintenance personnel comparison [2]

Methodology

International Civil Aviation Organization (ICAO) studies [4], [5] show a strong demand for qualified aviation personnel up to 2030. The underlying issues include:

- aviation professions not being sufficiently attractive to potential candidates;
- training capacity that is insufficient to meet demand;
- limited awareness among the next generation of the types of aviation professions available;
- learning methodologies that do not adequately address evolving learning styles;
- limited access to affordable training.

According to ICAO, solutions must be globally harmonized and should include:

- human-resource planning tools;
- broad cooperation among relevant stakeholders;
- accredited training and educational programs tailored to the next generation;
- mechanisms to harmonize training regulations.

Considering the solutions proposed by ICAO, the authors suggest that a combined method for training qualified aviation personnel can support the harmonization of training regulations—particularly academic and professional requirements—and thus related regulatory frameworks. This, in turn, may help reduce the shortage of professional and qualified aviation personnel, as the number of students enrolled in aviation academic programs significantly exceeds the number enrolled in professional programs in accordance with EASAA requirementsThis method will provide an opportunity to obtain an academic bachelor's degree while studying at a higher education institution

and, simultaneously, to complete the EASA Part-66 professional program in a Part-147 Maintenance Training Organisation and pass all required Part-66 module examinations for the relevant category.

Based on the above, it is proposed to combine the currently established methods of training aviation personnel. At present, two training methods are used in the aviation training domain: academic and professional.

- Academic programs, provided by higher education institutions, are typically accredited by the national Ministry of Higher Education. The Ministry sets educational standards and determines the content and procedures of training in accordance with the national Education Act, which defines all types and levels of education, outlines general principles, and specifies the competencies of governing bodies.
- Professional programs in the European Union (EU) for the training of aircraft mechanics, avionics personnel, pilots, air traffic controllers (ATCOs), and air traffic safety electronic personnel (ATSEP) are approved by the National Aviation Authority (NAA), which oversees aviation regulation at the national level. The European Union Aviation Safety Agency (EASA) establishes safety standards for the EU and associated countries, focusing on regulatory harmonisation and certification. Both EASA and NAAs follow the regulations issued by the European Commission (EC). EASA enhances confidence in safe air operations in Europe and worldwide by developing rules, standards, and guidelines, and by approving and overseeing organisations across all aviation domains, including training organisations.

For clarity and proper interpretation of the results presented in this article, the analysis focuses on the training of aviation personnel in aircraft maintenance conducted by an approved EASA Part-147 Maintenance Training Organisation for basic training in categories B1.1 (airplane turbine mechanics) and B2 (avionics).

Across many countries, there is a clear tendency among students to pursue a bachelor's degree in aviation, as higher education plays a significant role in shaping future career opportunities; this trend therefore cannot be overlooked.

On the other hand, to become certifying staff (qualified aviation personnel), one must obtain an Aircraft Maintenance Licence (AML), which is awarded upon completion of professional aviation training in accordance with EASA requirements. The AML authorises personnel to perform and certify aircraft maintenance. To apply for AML categories B1.1 and/or B2, in addition to theoretical and practical training and a type rating on a specific aircraft (e.g., Airbus A320 family), applicants must also acquire practical maintenance experience within an aircraft maintenance environment (such as a Part-145 maintenance organisation). This requirement can be met either by completing a Part-66 program in a Part-147 maintenance training organisation along with two years of maintenance experience, or by completing an academic program at a higher education institution combined with technical qualification equivalence to the Part-66 basic knowledge modules, certificates of passing all Part-66 modules at a Part-147 organisation, and three years of maintenance experience.

According to EASA requirements, completion of the Part-66 program requires passing all Part-66 module examinations within a Part-147 maintenance training organisation (a total of 17 modules, depending on the category). However, candidates who complete an aviation academic program may also attempt to pass all Part-66 module examinations at any approved Part-147 organisation.

Figure 2 illustrates the steps required to obtain an EASA Part-66 AML licence, comparing the academic and professional training pathways.

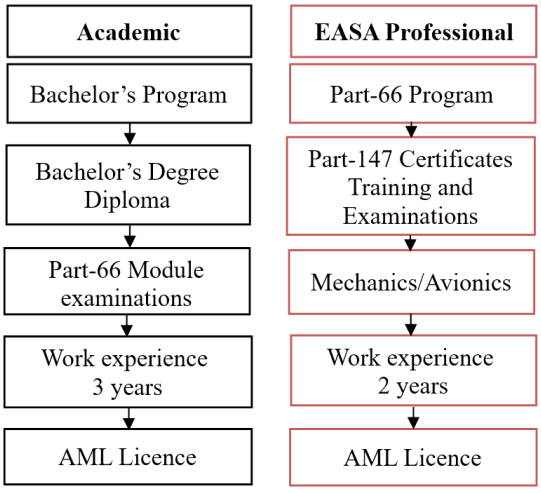

Figure 2. The possibility of applying for an EASA Part-66 AML licence

When providing combined training, the differences between the two programs, academic and professional, should be considered. Table 1 shows the main differences between the academic and professional Part-66 programs.

Table 1. Differences between academic and professional programs

No.	Academic program	Part-66 Program
1.	Semester cycle	Module cycle
2.	(4–5 subjects) on parallel	Usually one module/ subject
3.	Credit points (academic hours)	Astronomical hours
4.	One hour = 45 minutes (50 minutes)	One hour = 60 minutes
5.	Contact, non-contact hours	Contact hours only
6.	Homework	Homework
7.	Project work	—
8.	Examinations usually at the end of each semester (2 semesters a year)	Examinations at the end of each Module/subject during the training period
9.	Examination Mark – point (10-point system or equivalent)	Examination mark – %
10.	Pass mark 4 of 10	Pass mark 75% of 100%

Comparative analysis between aviation academic program and EASA Part-66 program

As mentioned above, for AML licence applicants who have completed the EASA Part-66 program, Part-147 training certificates and passed examinations, together with a specific aircraft type rating and two years of maintenance experience, are sufficient to apply for an AML Category B1.1 licence in any NAA. However, for applicants who have completed an academic program, it is additionally necessary for the NAA to review, convert, and accept the theoretical and practical courses obtained at a higher education institution. For this reason, and in accordance with EASA Regulation (EU) No 1321/2014 (SUBPART E, 66.B.400) [6], the NAA may grant examination credits to candidates applying for an AML licence. This means that the NAA may issue examination credits based on a credit report prepared in accordance with this regulation. The examination credit report must include a comparison of the following:

- the modules, sub-modules, subjects, and knowledge levels;
- the syllabus of the relevant technical qualification (academic program) in relation to the category being sought.

This comparison shall indicate whether compliance has been demonstrated and shall include justifications for each statement, as well as any conditions or additional considerations. No credit may be granted unless there is a demonstrated statement of compliance for each module and sub-module, clearly indicating where the equivalent standard is met within the technical qualification [6].

An examination credit report may either be developed by the NAA or submitted by another party and subsequently approved by the NAA to ensure compliance with Annex (Part-66). This article presents a method for preparing such a report, developed by the authors. In parallel, the authors provide a comparative analysis between the academic program and the Part-66 program, which can be formally accepted and approved by the NAA as an examination credit report.

It is proposed that a comparative analysis be conducted between the academic program and the Part-66 Category B1.1 program in order to provide a framework for combining the two pathways. This approach enables candidates to undertake the academic program and the Part-66 program in parallel. The comparative analysis covers all Part-66 modules, sub-modules, chapters, and knowledge levels contained in Appendix I to Part-66 [6], as well as the corresponding syllabus of the academic program relevant to the Part-66 category (Category B1.1). This comparison demonstrates whether compliance has been achieved and includes justifications for each statement (Table 2).

Table 2. Comparative analysis between aviation academic program and EASA Part-66 program

Part-66 Modules		Academic program		Comparison result	
Part-66 Module 8. Basic Aerodynamics	**Level**	**Program subject**	**Reference to Training Materials (TM)**	**Comply / Does not comply**	**Comments**
8.1 Physics of the Atmosphere International Standard Atmosphere (ISA), application to aerodynamics	2	Aerodynamics and Flight Dynamics	TM No. 1, Page 1/46–5/46 TM No. 2, Page 1–3 TM No. 3, Tutorial 1, Page 1	Comply	
…					
8.5 Flight Stability and Dynamics Longitudinal, lateral and directional stability (active and passive)	2		TM No. 1, Page 44/46–46/46 TM No. 2, Page 90–108 TM No. 3, Chap. 11, Page 1–25 TM No. 3, Chap. 12, Page 1–31 TM No. 3, Tutorial 4, Page 1–4 TM No. 4, Page 37–46	Comply	

No.	**List of Training Materials (TM)**
1.	EASA. Part-66. Training Handbooks. Module 8. Basic Aerodynamics. Link & Learn
2.	Flight Mechanics, Lecture notes, Course ME 4726, Department of Mechanical & Aeronautical Engineering University of Limerck, January 2001
…	…

Table 3 presents the Part-66 modules together with the corresponding subjects covered in the aviation academic program. If a Part-66 module is addressed by more than one academic subject, all relevant subjects are listed opposite the respective module. As an example, this applies to Module 11 (Aeroplane Aerodynamics, Structures and Systems) [7].

Table 3. Part-66 modules to academic program subjects

Pat-66 modules	Subjects of academic program
Module 1. Mathematics	Higher Mathematics
Module 2. Physics	Physics
Module 3. Electrical Fundamentals	Electrical Fundamentals
Module 4. Electronics Fundamentals	Electronic Fundamentals
Module 5. Digital Techniques/ Electronic Instrument Systems	Digital Equipment and Electronic Systems
Module 6. Materials and Hardware	Materials Engineering
Module 7. Maintenance Practices	Maintenance and Repair of Aircraft
	Organization and Provision of Aircraft Maintenance
	Aircraft Maintenance Planning
Module 8. Basic Aerodynamics	Aerodynamics and Flight Dynamics
Module 9. Human Factors	Human Factors
Module 10. Aviation Legislation	Aviation Legislation
Module 11. Aeroplane Aerodynamics, Structures and System	Aircraft Design and Strength
	Aircraft Liquid-Gas Systems
	Aircraft Avionics Systems
Module 15. Gas Turbine Engine	Aircraft Engine Design and Control Systems
Module 17. Propeller	Propeller and its Control Systems
N/A	Other subjects not covered by Part-66

Figure 3 illustrates the structure of the proposed combined academic and professional aviation program, in which Part-66 categories B1.1 (airplane turbine mechanics) and B2 (avionics) were taken as the basis. However, the same comparative approach can be applied to other aviation specializations, such as pilots, air traffic controllers, air traffic safety electronics personnel, and other related aviation fields.

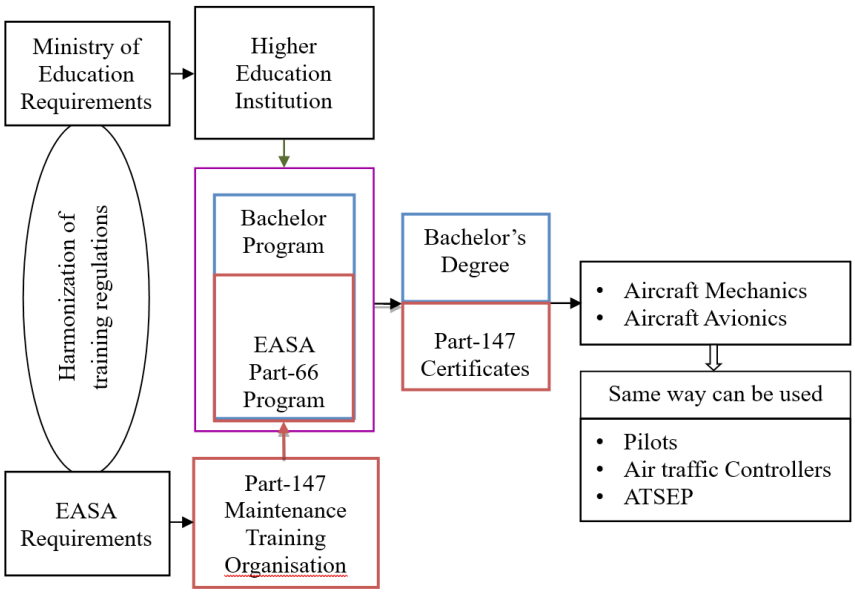

Figure 3. The structure of proposed combined aviation program

Results and discussion

- The proposed combined method of aviation training can support the development of highly qualified personnel in line with the current needs of the aviation industry and in compliance with EASA requirements.
- By following this integrated pathway, students can obtain Part-66 certificates—having completed the required training and examinations within a Part-147 Maintenance Training Organisation—while simultaneously earning a bachelor's degree in aviation.

Conclusions

The proposed systemic approach to aviation training can help to:

1. Reduce the discrepancies between aviation academic programs and the Part-66 training requirements.
2. Enable the integration of higher education with professional aviation training in accordance with EASA Part-66 standards.
3. Ensure that graduates obtain a state-recognized bachelor's degree in aviation, Part-147 training certificates, and become eligible to apply for an AML licence.
4. Support the harmonization of aviation regulations across higher education systems and professional training frameworks.

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