Efthymiou, M. (Ed.). (2023). *Air Traffic Management: Principles, Performance, Markets*. Taylor & Francis. https://www.routledge.com/Air-Traffic-Management-Principles-Performance-Markets/Efthymiou/p/book/9780367332440

Air Traffic Control Officers (ATCOs) Recruitment and Training

Gary McIlroy, Irish Aviation Authority, Ireland

Marina Efthymiou, Dublin City University, Ireland

Abstract

This chapter outlines the recruitment, training and licencing requirements of the Air Traffic Control sector as prescribed by ICAO Annex 1, Annex 11 and ICAO Doc 4444 PANS-ATM, ICAO Doc 9868 PANS-Training. These SARPs are then transposed by regional regulations where applicable (specifically Europe and EU 2015/340) and incorporated into state regulation. Specifically, this chapter will discuss the impact of those requirements on the people who operate within that sector, i.e., the ATCOs, from their recruitment to training and certification as licenced ATCOs operating in the live traffic environment. The chapter also researches a sample of ANSPs recruitment practices and makes some recommendations.

Keywords: Air Traffic Control Officers, ATCO training; ATCO mobility; ATCO recruitment; ATCO licensing

Introduction: The Global Standards for ATCO licencing

Aviation is regarded as the safest form of travel with every corner of the globe accessible by an aircraft. It has taken decades of commitment and desire for continuous improvement to bring the aviation industry to where it is today, allowing the management of millions of flights per year in a safe manner. Thousands of Air Traffic Controllers are employed worldwide, all of whom have a common objective, i.e., providing safe Air Traffic Control Services.

Due to the nature of the aviation system and how that system must be robust when coping with the volume and complexity of aviation traffic worldwide, all concerned states must

consistently apply the regulatory requirements. Doing so enhances standardisation and reduces the scope for differences and associated margins of error within the entire system.

ICAO aims to provide SARPs through 19 Annexes that govern the aviation industry's various elements across all 193 member states. The regulations providing the foundation for the recruitment, training and certification of Air Traffic Controllers is contained within ICAO Annex 1 - Personnel Licencing.

Section 4.1.1 and 4.1.2 outline the requirements for those who are not flight crew in the areas of "*age, knowledge, experience and where appropriate, medical fitness and skill, as are specified for that licence or rating.*" (ICAO, 2020, Pg. 19) This applies to Air Traffic Controllers and identifies that the State determines the demonstration of knowledge and skill. These standards provide the specific areas for which a contracting state must operate under and address when training and certifying an ATCO.

Section 4.3 addresses the management of Student Air Traffic Controllers but keeps the process to be followed open for contracting states to determine. It states: "*Contracting States shall take the appropriate measures to ensure that student air traffic controllers do not constitute a hazard to air navigation*" (ICAO, 2020, Pg. 102). It also ensures that student air traffic controllers cannot receive instruction in the operational environment unless they hold a Class 3 Medical Assessment. This is the key piece of regulation that transfers the responsibility for accepting student ATCOs into the aviation system and setting the minimum standard for their acceptance to each State.

The basic requirements for licencing and the awarding of ratings cover the areas of:

- Minimum age:
    - ICAO requires the minimum age of an applicant for an Air Traffic Controller licence to be 21 years of age. EASA, however, filed a difference to that requirement by prescribing a minimum age of 18 years for a Student Air Traffic Controller licence. This allows for the interim time period to cover the training as a student and maximises an ATCOs career by certifying them as operational as soon as legally possible.
- Knowledge:

    - Consisting of knowledge of Air Law, Air Traffic Control Equipment, General Knowledge, Human Performance, Meteorology, Navigation and Operational Experience.
- Experience:
    - Based on receiving a minimum amount of instruction from an On-Job-Training-Instructor (OJTI) in the live operational environment and satisfactorily passing all assessments.
- Medical fitness:
    - A Class 3 Medical Assessment is required for an Air Traffic Control Licence.
- English Language Proficiency:
    - As English is the recognised global language for aviation, all ATCOs must have a defined minimum command of the English language to conduct their duties safely. This enhances the standardisation process worldwide by ensuring the main language for communication with pilots and ATCOs is English.

The main requirements for air traffic controller ratings are in the areas of:

- Knowledge of various topics that are either generic or specific to a particular rating.
- Appropriate skill level demonstrated to ensure a safe, orderly, and expeditious service can be provided.
- Experience gained from having successfully completed a minimum number of hours or approaches depending on the rating and as specified in the Unit Training Plan developed upon the requirements.

Chapter 6.5 of Annex 1 outlines the requirements for the issuance of a Class 3 Medical Assessment to ATCOs and encompasses the following areas:

- Physical and mental requirements
- Visual requirements
- Hearing requirements.

Appendix 1 to Annex 1 outlines the requirements for proficiency in languages used for radiotelephony communication as outlined in section 1.2.9. The requirements apply to all aviation staff and are not specific to ATCOs only. Each State will determine when to use the

local language for coordination purposes with other Air Traffic Control Units, but English will remain in use for interactions with flight crew. For ATCOs, the requirement is contained within Annex 11 - Air Traffic Services section 2.31 (ICAO, 2018, Pg. 51) whereby it states:

"*2.31.1 An air traffic services provider shall ensure that air traffic controllers speak and understand the language(s) used for radiotelephony communications as specified in Annex 1.*

2.31.2 Except when communications between air traffic control units are conducted in a mutually agreed language, the English language shall be used for such communications. Appendix 1 describes the holistic descriptors which determine what qualifies as a proficient English language speaker."

As set by ICAO in Annex 1, these requirements are binding for the 193 member states. This ensures a minimum standard across the world of aviation English and allows for a mutual understanding of instructions, clearances, and interactions between ATCOs and flight crew. In general, native English speakers are exempt from this requirement; however, for EU states, since the publication of EU 2015/340, the requirement was introduced for native English speakers to also conduct an assessment with a maximum period before reassessment being reduced from no requirement to a maximum of nine years.

Air Traffic Controllers and pilots must meet a minimum standard of operational English to exercise the privileges of their licences. Air Traffic Controllers should also have a command of the language used in the country where the service is provided. By agreement, the local language may be primarily used when coordinating with colleagues at other units within the same State. There are six levels of proficiency, where the minimum level required to keep a licence valid is level four which indicates an operational level of English. Level four Air Traffic Controllers must be evaluated every three years. Level five, also known as 'Extended Level', must be evaluated every six years. Finally, Level six is classified as 'Expert' level. While ICAO Annex 1 (2020) states, "*Formal evaluation is not required for applicants who demonstrate expert language proficiency, e.g. native and very proficient non-native speakers with a dialect or accent intelligible to the international aeronautical community*", for European Air Traffic Controllers, EU 2015/340 states, "*(3) for expert level (level six): (i) nine years from the date of assessment, for the English language*".

Both documents are quite specific in the requirements to be met to be classified under any level. While level 4 is the stated minimum requirement for operational use, some ANSPs may specify a higher level due to the complexities of their operation considering the volume of traffic, the airlines' geographical spread subject to air traffic control and the quality of English from those pilots where English is not their native language.

While ICAO Annex 1 and Annex 11 are the overarching standards for the licencing and procedures for ATCOs, PANS- ATM DOC 4444 is then utilised for providing in more detail the procedures to be used for licenced ATCOs to provide a service in the operational environment. It forms the basis for the theory during training and for live operations by ATCOs when providing a service worldwide. It comprises the various elements of Annex 2 - Rules of the Air and Annex 11 - Air Traffic Services.

Much of Doc 4444 for European states has been transposed into EU Law via SERA (Standard European Rules of the Air) and EU 2017/373 Air Traffic Management/Air Navigation Services Common Requirements. DOC 4444 (2016) specifies in section 2.5.1 that Safety Reviews must be conducted on ATS units at regular intervals, and one of the areas of focus is on licencing and training issues. This is conducted to ensure the following (ICAO Doc 4444, 2016: 44):

"a) controllers are adequately trained and properly licensed with valid ratings;

b) controller competency is maintained by adequate and appropriate refresher training, including the handling of aircraft emergencies and operations under conditions with failed and degraded facilities and systems;

c) controllers, where the ATC unit/control sector is staffed by teams, are provided relevant and adequate training in order to ensure efficient teamwork;

d) the implementation of new or amended procedures, and new or updated communications, surveillance and other safety significant systems and equipment is preceded by appropriate training and instruction;

e) controller competency in the English language is satisfactory in relation to providing ATS to international air traffic; and

f) standard phraseology is used."

As prescribed by Doc 4444, this mechanism allows for the continued monitoring and improvement of the ATC element of the overall aviation management system.

For the European States, ICAO Annex 1 has been largely transposed into European Law via regulation EU 2015/340. Most of the principles of Annex 1 are included with additional content inserted by EASA to outline AMC and GM for each of the regulations. While the regulation itself is classed as hard law, the AMC and GM are classed as soft law, meaning it is a recommendation rather than a requirement.

The terminology described is common to most ICAO states, but some states do have some differences. For example, in the United States and under the FAA, the various ratings and endorsements differ greatly. The FAA Basics Course is like ab-intio training as generic training delivered to all students. Initial Tower Cab is like the training delivered to become an Aerodrome Controller (Ground Movements Control and Air Movements Control). Finally, the Terminal Basics Radar is like an Approach Radar Training Course. This training is broken down into three levels which increases in complexity and assist in determining the type of terminal area the student will be capable of working in, from complex to non-complex.

ICAO Doc 9868 PANS Training was initially introduced to provide the competencies-based approach to training for pilots. In 2015 this was further expanded when the development of competency-based frameworks and assessment practices for ATCOs occurred. This document complements the ICAO SARPs and contains the actual procedures to follow when training organisations to train industry-specific personnel. As specified in chapter 2.1.1 in the document, "*The goal of competency-based training and assessment is to provide a competent workforce for the provision of a safe and efficient air transportation system. To focus training and assessment on how an aviation professional is expected to perform on the job competently, a description of this performance in the particular operational and environmental context is needed. The adapted competency model, with its associated performance criteria, provides a means of assessing whether trainees achieve the desired performance.*" (ICAO, 2020, Pg. 33).

As summarised in figure 1, the recommended format is to first outline the Training Specification for the required role, i.e. what exactly is the Service Provider looking for within a specific role. This process takes the various inputs of the training request, task list, operational documents, technical documents, regulatory documents, and organisational documents as terms of reference and identifies the requirements associated with each.

<Insert Figure 4.1 here>

Figure 1: Competency-based training and assessment components.

That specification is then adapted along with the ICAO competency framework into a competency model for that role by selecting the necessary competencies and observable behaviours required and to what level the individual should perform those skills through the implementation of performance criteria.

Once that competency model has been established, then two plans are created. A training plan details the structure of the course, the syllabus, the milestones, the modules, training events and their delivery sequence and the course schedule. The training plan forms the main reference guide for training delivery to ensure the correct information is delivered in the correct sequence. The training plan is an assessment plan that outlines the standards expected and the parameters for each assessment, such as the grade required, the tools to be used and the time allowable.

The assessment plan should also include various mechanisms such as appeals procedures or the processes to be followed in an unsuccessful assessment. This is critical as it ensures a robust process and does not leave it open to differences in interpretation and appeal. These materials are then submitted to the Competent Authority or Regulator of the State for review and approval. The Competent Authority reviews the content and compliance with the ICAO standards before approving or rejecting the submission.

Once approved, the training and assessment materials must be created for delivery to the individuals. This process takes the adapted competency model, assessment, and training plan and develops training materials, examinations, and assessments.

This results in the course schedule, training event materials such as notes, case studies, exercise briefings, presentations, video clips, training airspace and exercises, examinations, practical assessments, and other assessments. Instructors assist in its creation as it proves to be a useful mechanism for restorative procedures before delivering the content to the students.

There are several benefits and challenges to the competency-based training and assessment system. The benefit allows for increased potential from the candidate as it divides the qualities between theory-based knowledge and skill-based knowledge. Both types are very different as a student may excel at academia and can absorb large volumes of information but may struggle to put that knowledge to use by displaying the skills required to perform the role. Likewise, the system allows for a student who may not have the same capacity for absorbing information but understands how the role works and can display the skills appropriately. Using the competency-based training and assessment system allows a wider range of students to perform adequately across both areas. It further guarantees for the ANSP that the minimum quality required for the role is being achieved.

By conducting the course as intended, competent trainees should be the output. Once training is complete, for continuous improvement and quality management purposes, the ANSP needs to evaluate the course and the training. This involves the analysis of the course results, trainee feedback, instructor and assessor feedback and any audit reports that may have been generated. These will determine improvement areas and generate a comprehensive course report for the Training Organisation and ANSP. In some circumstances, the ANSP may be acting as a customer of the Training Organisation.

The competency-based training and assessment system carries its challenges, particularly with the constant evolution of roles within the aviation industry resulting from increased automation and new technologies, leading to different operating methods. This results in the competencies being adjusted and the requirements to be met being altered. However, through constant review and updating of the various training plans, the system can address many challenges. ICAO Doc 9868 Attachment A to Chapter 2 outlines some challenges to competency-based training, mainly based on ensuring the right competencies have been identified and the proper delivery of KSAs to perform effectively.

For ATCOs to meet the defined performance criteria under the Competency Based Framework, they need to display the appropriate levels of Knowledge, Skills and Attitudes as defined in ICAO PANS-Training Attachment B to Chapter 2 section 2.2, section 3.1 and section 4 respectively and outlined below. Knowledge is defined as "*an outcome of the learning process, whether learning occurs in formal or informal settings*" (ICAO, 2020, Pg. 41). A skill is defined as "*an ability to perform an activity or action. It is often divided into three types: motor, cognitive and metacognitive skills*" (ICAO, 2020, Pg. 41). Finally, attitude is defined as "*a persistent internal mental state or disposition that influences an individual's choice of personal action toward some object, person or event and that can be learned*" (ICAO, 2020, Pg. 41). Only when an acceptable level of all three of these qualities is displayed can a student ATCO be assessed and certified as competent to perform the role in the operational environment without supervision.

PANS - Training Doc 9868 also outlines the processes for the training of OJTIs. These are qualified air traffic controllers who, following a pre-defined number of years of gaining experience within the role, can then receive training to become OJTIs. This is a nuanced area as they provide instruction within the classroom environment to student ATCOs and utilise their own ATCO licence to provide instruction to student ATCOs in the live operational traffic. This allows the students to display their knowledge, skills, and attitudes in the live environment and allows for the most accurate assessments of the student's capabilities when performing the role. Pans - Training Doc 9868 Part IV Chapter 3 provides the framework for OJTIs to be trained using the competency-based framework. Those competencies include:

- Situational Awareness,
- Safety and Efficiency Management,
- Mentoring,
- Teaching, Instructing and Coaching,
- Communication,
- Assessment,
- Collaboration,
- Self-Assessment
- Ethics and Integrity

Successful completion of the OJTI training and assessment program entitles the ATCO licence holder to an additional endorsement on that licence which permits them to provide OJT in the live operational environment.

These standards and procedures provide the framework that permits the various states affiliated with ICAO to develop and deliver Air Traffic Control training within their State, thus contributing to the safety and integrity of the overall aviation management system. The next section analyses in further depth the various ratings and endorsements a student ATCO can achieve and their pathway from recruitment until receiving the new ATCO licence.

An ATCO licence contains several elements. The main elements are ratings and endorsements. Ratings are the specific type of Air Traffic Control to be provided. Air Traffic Controller Ratings consist of the following:

- Aerodrome Control Visual (ADV)
- Aerodrome Control Instrument (ADI)
- Approach Control Procedural (APP)
- Approach Control Surveillance (APS)
- Area Control Procedural (ACP)
- Area Control Surveillance (ACS)

The word surveillance indicates the use of a surveillance radar system, and the word instrument indicates that the Aerodrome Controller can use a surveillance monitor to assist with their duties.

The following Rating Endorsements then supplement the ratings mentioned above:

- Air Control (AIR)
- Ground Movement Control (GMC)
- Tower Control (TWR)
- Ground Movement Surveillance (GMS)
- Aerodrome Radar Control (RAD)
- Precision Approach Radar (PAR)
- Surveillance Radar Approach (SRA)

- Terminal Control (TCL)
- Oceanic Control (OCN)

Multiples of these endorsements can supplement any one of the ratings specified above. Finally, a Unit Endorsement is required to be included on the licence. This outlines where the Air Traffic Controller can provide the service and will include for Radar Controllers multiple sectors or for an Aerodrome Controller, the specific aerodrome the service will be provided. These ratings and endorsements determine the training a student receives and depend on where the student is destined to operate within the ANSPs organisational structure.

The ATCO Categories

Wickens et al. (1997:23) stated, "*The typical controller is able to address the sometimes-conflicting pressures for safety and efficiency in two ways: (1) by adhering to a well-developed and extensive set of FAA procedures that have evolved over the years and (2) by being able to augment them with skilled problem solving on the infrequent occasions when following procedures fail to specify the appropriate actions*". It indicates that an Air Traffic Controller must have the aptitude to process an abundance of information about the environment they are controlling and compare that information against published procedures to make informed decisions about the next course of action. But in the absence of a procedure for a particular circumstance, the Air Traffic Controller relies upon their knowledge, skills, and attitude to make their personal decision towards a safe course of action to resolve an issue.

An Air Traffic Controller can operate in any one of several capacities which cover the various phases of a typical flight. A Tower controller comprising a Ground Movements Controller and an Air Movements Controller are the first and last ATCOs a typical flight will be speaking to. There could be multiples of these operations at an airport at any one time depending on the airport's configuration, such as single runway operations or parallel runway operations. The Ground Movements Controller is responsible for the safe movement of the aircraft pre-flight, from the moment it is ready to push back from the gate through to taxiing safely around the taxiways at the airport to the holding point of the runway in use. They also manage vehicles that have been authorised to operate around the taxiways and runways and ensure no risk of collision between aircraft and vehicles. The aircraft is handed over to the Air Movements Controller at the holding point for the runway in use. The Air Movements Controller manages

the runway in use and ensures that arrivals and departures to that runway occur safely while also maximising the use of the runway depending on demand and how busy the airport is. The Air Movements Controller is also responsible for the airspace around the vicinity of the aerodrome. This allows the ATCO to control other aircraft flying in close proximity to the airport known as GAT (General Air Traffic). Suppose the airport is configured for parallel runway operations.

In that case, there may be a second Air Movements Controller working close to their colleague, whereby one runway is used for arrivals in some circumstances, and the other runway is used for departures. Again, these configurations can vary depending on traffic demand. Suppose an aircraft executes a missed approach or 'Go Around'. In that case, communication and separation from any essential traffic become the priority for these controllers to ensure the manoeuvre is safe and does not interfere with any other traffic in the vicinity of the aerodrome. Once the departing aircraft has reached a certain point on its climb out, it will transfer over to the first Radar Controller, commonly known as the departure controller for busier airports. They ensure the aircraft clears the busy aerodrome environment before transferring it onto the Area Radar Controller, who controls the aircraft up to its cruising altitude. Depending on the airspace layout, the aircraft may still climb to its cruising altitude before it leaves the airspace sector concerned.

The aircraft will then be transferred to the Area Controllers counterpart in the next sector that will continue to provide the service in their sector of responsibility. With the assistance of their colleagues in different sectors and countries, the aircraft safely navigates towards its destination, where it will then begin its descent for its arrival. The Area Radar Controller will then transfer the aircraft for the arriving sector to the Approach Controller, who sequences the aircraft with the other arrivals. Once the aircraft is established on its instrument approach for the arriving aerodrome, it will be transferred to the Air Movements Controller, who will clear the aircraft to land when the runway is clear. When the aircraft vacates the runway, it will be transferred to the Ground Movements Controller, who will provide route instructions to the parking stand. Each commercial flight worldwide will undergo the same or a similar process and engage with multiple Air Traffic Controllers, either as Tower Controllers or Radar Controllers.

A successful candidate receives basic air traffic controller training or ab-initio training at a high level. This is training common to all air traffic controllers, irrespective of which area they eventually end up providing a service in. It covers eleven modules with an exam for each with a pass mark of 75% required to complete the training. Once this training is completed, they will commence rating training, generally for either Aerodrome Control or Radar Control. One of the ratings is supplemented by at least one endorsement. This training will contain a mixture of theoretical and simulation training, with multiple exams and checks. From here, the controller will be awarded a Student Air Traffic Controller Licence. This allows the student to exercise their knowledge in the live environment under the supervision of an OJTI.

ATCO Training

ATCOs receive a combination of formal classroom instruction and on the job training. But a candidate must possess certain qualities to be successful in the various phases of training. These qualities are identified at the screening stage through interviews and aptitude testing with current emphasis on a 'train for success' philosophy, designed to reduce training program attrition as identified by Wickens et al. (1997).

For training delivery, it is not up to the ANSP to decide what should and should not be included. ICAO Annex 1 - Personnel Licencing provides an overview of what subjects must be delivered when training Air Traffic Controllers for each Rating and Endorsement. These are also reflected for European ANSPs but in more detail in EU Regulation 2015/340 'Rules for Air Traffic Controller' Licencing and Certification'. It also specifies the requirements for instructors, assessors, training organisations, competence schemes and medical certificate requirements. While it is based on ICAO Annex 1, EU 2015/340 has developed these regulations significantly. For the delivery of Initial Training, for example, EU 2015/340 AMC1 ATCO.D.010(a)(1) outlines the various subject objectives and training objectives for each subject which includes:

1. Introduction to the Course
2. Aviation Law
3. Air Traffic Management
4. Meteorology
5. Navigation

6. Aircraft
7. Human Factors
8. Equipment and Systems
9. Professional Environment
10. Abnormal Situations
11. Aerodromes

Subjects 1 - 9 are generic across all ratings, while subjects 10 and 11 are specific to Unit Training.

Much of the content of Air Traffic Controller training is contained across the 19 ICAO Annexes or, more specifically, in EU Regulations, where training objectives and AMCs are included. This ensures a minimum level of knowledge is possessed by Air Traffic Controllers worldwide. That knowledge is consistent whether a pilot receives instructions from an Air Traffic Controller in the United States, Europe or New Zealand. In support of the ICAO Annexes are ICAO Docs which provide further details to the standard contained in the Annex. For example, Doc 4444 contains the procedures relative to Air Traffic Management and is the global bible for Air Traffic Controllers worldwide. In Europe, the European Commission, through EASA, has outlined the procedures through regulation and categorised them differently. For example, ICAO Annex 11 - Rules of the Air is captured under EU 923/2012 SERA (Standardised European Rules of the Air). Much of the content is the same, and EASA does attempt to comply as much as possible with the ICAO standards. The European Regulations are more comprehensive in their provision of soft law AMCs and GM, which complement the regulations. This ensures a harmonised approach by all member states towards adopting the regulations.

Selected examples of ANSP's Recruitment and Training Practices

We compared the practices for recruitment and training of 8 ANSPs worldwide. More specifically, we looked at Federal Aviation Administration (FAA), Nav Canada, Irish Aviation Authority (later renamed to AirNav Ireland), PANSA (Poland), ATNS (South Africa), GCAA (UAE), Aerothai (Thailand) and Airways New Zealand. We focused on the minimum and maximum age, medical requirements, security checks required, education requirements, citizenship, English language proficiency, aptitude testing, training costs, and duration. From the sampling of ANSPs regarding the recruitment policies, the analysis produced some

interesting observations. Table 1 below provides a high-level overview of the main areas considered in the training and recruitment of ATCOs by various ANSPs.

	FAA	Nav Canada	IAA	PANSA	ATNS	GCAA	Aerothai	Airways New Zealand
Minimum Age	18	18	19	19	18	19	21	20.5
Maximum Age	30	Nil	Nil	Nil	33	25	27	Not Stated
Medical	FAA Second Class Medical	Class 3	Class 3	Class 3	Class 3	Class 3	Class 3	Class 3
Security Check	Yes	Yes	Yes	Yes	Yes	Yes	Not stated	Yes
Education	Third Level	Secondary Level	Secondary Level	Secondary Level	Secondary Level	Secondary Level	Third Level	Secondary Level
Citizenship	Yes	Yes + Permanent Resident	No	No	Yes	Yes + Foreign Direct Entries	Yes	Yes+ Permanent Resident
Training Costs	Not Stated	Yes	Yes	Yes	Yes	Yes	Yes	Not Stated
Aptitude Tests	Online + Written	Online + Group +Interview	Online + Group + Interview	Online + Interview	Written + Interview	Not Stated	Yes	Online + Group + Interview
Allowance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not Stated
Accommodation	Yes	Not stated	No	Yes	Yes	Yes	Yes	Not Stated

ELP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not Stated
Duration	60 Months	10 -27 Months	24 Months	20-22 Months	30 Months	36-60 Months	48 Months	12 Months

Table 1: Comparative Analysis matrix of sample ANSPs

Minimum, Maximum Age Requirement

The ICAO minimum age requirement is 21 years for the issue of an ATCO licence. This requirement does not prohibit an ANSP from hiring at a younger age to provide training leading to the 21st birthday and the application of an ATCO licence. This is the approach that most ANSPs have followed. EASA specifies a minimum age of 18 years, focusing more on education and aptitude testing for a better recruitment policy. However, the two European States sampled at IAA and PANSA have opted for a minimum age of 19 years, considering their estimated 24-month training program. GCAA has followed the European model in applying the minimum age profile. This allows for two years of training and maximises the ATCO's availability to be ready for operations as close to the 21st birthday as possible. The FAA, Nav Canada and ATNS have specified 18 years as minimum age while surprisingly Airways New Zealand specified 20.5 years.

Interestingly the FAA, ATNS and GCAA specified an upper age limit of 30, 33 and 35 years respectively for recruiting new ATCOs. An increase to 36 years of age is possible for the FAA to concern a rated controller with 52 weeks of experience. When queried with the IAA about a maximum age limit, they stated that it is impossible to introduce a maximum age within the EU as it breaches equality legislation for equal opportunities. PANSA also confirmed this. For Aerothai, as training leads to awarding a third level degree, the minimum age of 21 is applied. However, the training is delivered before that age, as upon graduation, all candidates will naturally exceed the minimum age requirement. Aerothai also has a maximum age requirement of 27 years.

Medical Requirement

A class 3 medical assessment is required by ICAO and is largely included within the recruitment campaigns for each of the ANSPs. However, some differences in terminology are used. The FAA filed a difference to ICAO regulations within their AIP section Gen 1.7, requiring an 'FAA Second Class medical.' Airways New Zealand specified 'to pass a medical test'. Still, as it is an ICAO requirement for a Class 3 medical assessment and no differences were filed, it can be assumed that this is the standard of medical examination used.

Security Check

While ICAO and EASA do not specify the requirements for candidates to undertake a security check, this is required under national law and is captured under each ANSPs Security and Human Resources policy. Since the various high-profile security attacks on aviation and counter-terrorism efforts, background checks (including cyber security checks) are performed on all candidates. Except for Aerothai, all sampled providers specify the requirements to clear a security check successfully. Nav Canada includes drug screening (including cannabis) as part of the check.

PANSA specifies that candidates enjoy full public/civil rights. Still, security checks may be performed randomly by requiring the candidate to deliver an actual document confirming that they are not figuring in their National Criminal Register. Also, during the licencing process, the candidate must sign a form that declares that they have not been sentenced for a deliberate offence, have the capacity for legal acts, and were never convicted of motoring offences.

ATNS specify that the security check process is to verify qualification, identity, and criminal record. For recruitment with the GCAA, the security check is to verify completion of the Military Service training. This is a different scenario versus recruiting direct entry controllers from abroad.

Education Requirements

ICAO and EASA do not specify specific education requirements, with each State determining their requirements to perform the role. It coincides with the different approaches to training

and assessment, with the more common form now being the Competency-Based Framework per Pans Training Doc 9868.

The FAA has one of the most interesting education requirements. The FAA (2020) specifies, "*Have three years of progressively responsible work experience, or a Bachelor's degree, or a combination of post-secondary education and work experience that totals three years*." There is a third level education pathway through the FAA accreditation program to allow a candidate to be considered for a training program. Education requirements are an interesting area for analysis as they are set by the State and differ greatly from one State to another. A third level qualification is required in countries like the United States and Thailand. It is catered for specifically in aviation colleges with a Bachelor's of Science Degree related to Air Traffic Management. This shows an incredibly long pathway towards an ANSP gaining new operational staff.

The most common form of recruitment into the FAA is directly from the military pool of ATCOs, which guarantees the experience and takes advantage of the military training system to ensure an acceptable level of competence. The Air Traffic Collegiate Initiative (AT-CTI) program, implemented in 1989, supplements the FAA's hiring pool. The AT-CTI program objectives are the following (Ruiz & Ruiz, 2003):

- Test the concept that non-federal, post-secondary educational institutions can develop, deliver, and implement air traffic control recruiting, selection, and training programs.
- Attract females and minorities to careers in air traffic control.
- Develop a more educated work force in the FAA.
- Use collegiate aviation as one of the primary means of meeting the future needs of the FAA for air traffic control specialists (ATCS).

The AT-CTI program is conducted across 14 educational facilities across the United States. The FAA does not fund it, so students must pay for their education. As Ruiz (2007) suggests, the FAA's endorsement of the AT-CTI program increases the program's credibility, legitimacy, and popularity among potential applicants. Nevertheless, there is still no guarantee that the knowledge and skills of a student graduating through the AT-CTI program will transfer over

effectively to the FAA Training Academy and the operational Air Traffic Environment. It also takes 4 years before FAA has an investment return from this endorsed program and then a steady flow of students annually after that. The length of the process could result in a decline in the number of potential candidates interested in following this pathway.

Another point of consideration is that those who receive a college education will also be more suitable for continuing through the organisational structure into management positions with basic qualifications already achieved rather than relying on continual professional development when operational.

Nav Canada and PANSA, on the other hand, requires a High School Diploma or equivalent. Similarly, IAA's focus is on secondary level education requirements, allowing the candidate to prove their eligibility through aptitude testing and the competency-based training framework. The IAA specified a Leaving Certificate with five passes (including maths) with Grade C in two higher-level papers. This ensures that the candidate not only passed secondary level education but achieved a certain standard in doing so.

ATNS also focuses on secondary level education requiring a grade 12 with Mathematics and English. GCAA requires a high school certificate with a minimum average of 70%. This minimum percentage is consistent with an acceptable level whereby the pass grade for any ATCO assessments is at 75%, thus ensuring an acceptable level of competence before recruitment. Airways New Zealand has several entry paths. They require a National Certificate in Educational Achievement (NCEA) Level 3 or a personal or commercial pilot licence to be accepted. They specify that NCEA Level 3 is required for tertiary training with subjects including Mathematics and English.

Aerothai specifies their education requirements through the CATC used to train aviation personnel, including ATCOs. Aerothai requires candidates to have completed high school or equivalent while majoring in Science and Mathematics. As all elements of aviation training are associated with a third level qualification, the delivery and assessment methods are subject to additional academic rigour and aviation regulatory oversight.

Citizenship

While ICAO and EASA do not have any citizenship requirements, many nations do. Primarily this is because ATCOs can be classed as civil servants. Many countries will only accept citizens as civil servants, narrowing the pool of eligible ATCOs. This has a negative effect on mobility and interoperability between states which can limit the number of options available when trying to address a shortfall in the number of ATCOs from time to time.

The FAA, ATNS and Aerothai specify the requirement to be a citizen while Nav Canada and Airways New Zealand require citizenship and accept permanent residents. The same applies to GCAA when recruiting citizens, but they also accept direct entry ATCOs from abroad, which are accepted subject to other assessments discussed further below.

For IAA and PANSA, there is no citizenship requirement as the eligibility falls within EU 2015/340, which facilitates interoperability and mobility across all EU states under the Single European Sky concept. However, particularly for Poland and other EU states where English is not the native language, it is also a requirement for the ATCO to be fluent in the native language of that State.

English Language Proficiency

ICAO Annex 1 and EU 2015/340 outline the English language proficiency requirements that all states must follow. These requirements can be interpreted in several ways by ANSPs. For example, The FAA (2020) requires that candidates speak English clearly enough to understand communications equipment. Nav Canada (2020) requires candidates to meet language requirements (a high level of proficiency in English and French for the Montreal Flight Information Region (including the National Capital Region) and just English for all other regions**.** The IAA, as a native English-speaking country, requires the language level in accordance with EU 2015/340.

PANSA conducts their aptitude testing in English and interviews in both English and Polish. The initial acceptance of a candidate's level of English is by the recruiting board and the competent authority conducts the first English language proficiency exam before a student licence is issued. On the other hand, ATNS amalgamate the level of English required into the academic qualifications needed to gain entry for training. Once a grade 12 with Maths and

English is achieved, that is acceptable for further training. GCAA specifies that UAE Nationals must have the ability to understand and fluently communicate in English. At Aerothai, the English language teaching is conducted at the training college and forms part of the overall third level degree in Air Traffic Management. The candidates are assessed at the interview stage for a certain level of English and then, on completion of training, will conduct the ELP as required.

Aptitude Testing

ICAO and EASA do not specify the standard for aptitude testing, and this is a concept that is very much ANSP specific. A company wishes to hire the right people for the job and thus will tailor their screening forms accordingly. Various digital programs are designed for aptitude testing of potential ATCOs with other ANSPs also using variations of the same concept.

The FAA conducts two forms of assessment. The first is a Biographical Assessment, which is used to identify candidates who have the highest probability of reaching final controller certification. They also conduct an Air Traffic Control Specialist Skills Assessment (ATSA), a battery of tests that measure abilities and characteristics shown to be predictive of success as an Air Traffic Control Specialist (ATCS). Depending on the pathway the candidate is being recruited for, it will be either the biographical assessment on its own or both biographical assessment and ATSA if destined for more pressurised environments.

Nav Canada conducts an online assessment for cognitive testing as the initial screening mechanism. This is followed up with an in-person test that may test communication, memory, working speed, spatial visualization, thinking and reasoning, attention, information processing, and simple math. Finally, an in-person assessment is undertaken at a Nav Canada facility whereby an interview, group and individual exercises or simulations occur.

The IAA breaks their aptitude testing into four parts. Part one is the FEAST (First European Air Traffic Controller Selection Test) which Eurocontrol designed to help identify the most suitable candidates. It covers the areas of cognitive ability, knowledge, English language comprehension, multitasking, and a personality questionnaire. All these areas satisfy the ICAO standard of addressing Knowledge, Skills and Attitude. Part two is the DART (Dynamic ATC Radar Test) test which simulates a Radar environment for which candidates must guide

aircraft to various positions. Part three covers work strengths profiling conducted through a group interview and exercise. This part assesses the teamwork element of the screening process. Finally, part four is a competency-based interview.

PANSA also conducts FEAST and DART testing as part of their screening process. This is combined with a complex interview that focuses on multitasking, English language comprehension, memorising capabilities, spatial and situational awareness. ATNS require candidates to undertake written ability assessments. An interview then follows this. GCAA also specifies that aptitude testing is undertaken, but it does not specify what mechanisms are in place for the f aptitude testing. Aerothai also does not specify their aptitude testing process, but it is believed to be associated with the third level degree and acceptance to that form of training.

Airways New Zealand specifies that candidates must pass aptitude tests, interviews and group exercises but does not specify the mechanism for conducting those assessments. Aerothai likewise indicated that aptitude testing does occur but did not provide any further information on the testing method.

Training Costs and student allowance

It is a business decision for each ANSP to manage the costs of providing training to student ATCOs. The costs associated with the provision of training can vary, but this is often offset against contractual financial commitments for the ATCO to remain with the ANSP for at least a specified period for the ANSP to recoup the cost of investment.

In the case of the FAA, Nav Canada and Airways New Zealand, this financial aspect is not specified as part of the recruitment campaign for ATCOs. For the IAA, PANSA and GCAA, the training costs are covered by the ANSP. For ATNS, the first year is covered by a bursary awarded by the company. On completion of that first year, a review is conducted to ascertain students' performance before commencing year two. If successful, they will be retained as employees for year two and paid. Finally, for Aerothai, although training is linked with a third level degree, the cost is paid by Aerothai.

It is an ANSP decision as to whether to award an allowance to students. The level of financial assistance awarded to students will influence the candidates' pool. The FAA pays their

students an allowance of $18,343 while at the FAA Academy in Oklahoma. Nav Canada also pays an allowance, but the exact figure is not listed as it depends on the training pathway for the student and the ratings they are training for. The IAA pays an allowance to students until they commence OJT, which will move them onto the first point of the ATCO pay scale as employees. PANSA also pays their students as they become PANSA employees from the beginning. ATNS, Aerothai and GCAA pay their students a monthly allowance.

In terms of accommodation, the FAA provides accommodation to students in the Oklahoma area with several approved housing providers. It is a cost to the student with pre-defined daily rates at $62.40 for long term letting (16 class days or more) and $104 for short term letting (15 class days or less). The training facility will pay the costs associated with student ATCO's only. ATNS and GCAA both provide accommodation for students, whereas the IAA does not arrange accommodation for students. PANSA does provide accommodation for students living outside of Warsaw, where the training headquarters is located. Aerothai provides accommodation depending on where the student placement takes place. If the placement takes place at one of the regional centres, accommodation is provided, but accommodation will not be provided if the placement is at Aerothai Headquarters.

Training Duration

There are varying degrees of length in training for ATCOs. This depends primarily on the business needs of the ANSP. For the FAA, because of the educational requirement before joining the academy, it is approximately five years of training broken down into three years for a college degree and two years of academy training. This seems overly restrictive on mitigating against a turnover of air traffic controllers, which has been an issue in the past.

Nav Canada is more expeditious in the delivery of its training programs. Tower ratings will take between 10 to 18 months of training. For Radar training, the time period is increased to between 20 and 27 months. The IAA has indicated that it is 24 months of training, irrespective of the rating to be achieved. PANSA training is up to 33 months, but the students will often be operational between 20 and 22 months. ATNS training is 30 months in length, with the contractual obligations are broken down into the 12-month bursary followed by an 18-month fixed contract to finish the unit training.

For the GCAA, recruiting and training internally shows quite a variance in the time required to train an ATCO. Depending on the air traffic facility, from classroom student to licenced air traffic control officer can take three to five years. As Aerothai associates their training with a third level degree, it takes four years to train ATCOs. Airways New Zealand has the quickest turnaround in ATCO training, outlining that a 12-month period is required to provide a Diploma in Air Traffic Control (Level 7). This comprises six months of theory and six months of on-the-job training.

Labour Market Mobility considerations

While ATCOs do not experience retention issues like those of pilots (Efthymiou et al., 2021), there can be a significant shortage of experienced ATCOs. Across the world, there have been continued reports of shortages in Air Traffic Controllers. People management by the respective service provider may have added to those difficulties through negative reactions to industry shocks such as 9/11, the financial crisis of 2008 and Covid-19, whereby the initial reaction is to adjust the level of service to meet the immediate demand. As a reaction to these shocks, ANSPs tend to cancel Air Traffic Controller training and encourage retirements, therefore, choking the supply of controllers for operational use.

Unfortunately, it takes a long time to train an Air Traffic Controller. As discussed in the previous section, some countries take quite a bit longer than others because of a national requirement for an Air Traffic Controller to possess a third level qualification first. The quickest time period for training an Air Traffic Controller for operations is a minimum of two years. This means that ANSPs will struggle with the consequences of staffing decisions as an initial reaction to an industry shock. It is difficult to manage as the aviation industry has a history of rebounding from shocks quickly (Corbet et al., 2019; Akyildirim et al., 2020; Warnock-Smith et al., 2021), faster than the training of any ATCO. When that environment is created, the demand and urgency for Air Traffic Controllers increase, so ANSPs look at ways to recruit Air Traffic Controllers through other means. In the United States, after the Air Traffic Controller Strike against President Regan in 1981, the focus turned towards hiring current and ex-military Air Traffic Controllers and endorsing a collegiate training initiative for educating potential Air Traffic Controllers as part of a university degree program to help address the shortage. These processes are still in existence today.

In the UAE, an Assessment of Previous Competence (APC) is conducted on experienced Air Traffic Controllers from other nations before direct entry recruitment to determine their level of suitability for operations in the busy traffic environment before deciding on whether to employ the controller or not. It is a cost-effective tool that helps the ANSP determine that the candidate has the right knowledge, skills and attitude for the role in the high-intensity work environment. While APCs are commonplace for airlines recruiting flight crew, it is a concept that some states have adopted for the recruitment of licenced ATCOs to determine that the level of competence is suitable for the demands of that State. APCs are not regulated by ICAO for ATCOs. Still, they are viewed by the states that use them and have received Competent Authority approval for their use as an effective screening mechanism.

For the UAE, the process spans three days. The candidate is provided with the relevant procedures and materials to pre-brief on before arrival to reduce briefing time on site. A written exam is conducted with the candidate based on the procedures and relevant ATC knowledge required before the simulation assessments. The exam was introduced as candidates were arriving without understanding the procedures to be employed in the simulator resulting in a high failure rate. The candidate would then get a test run on the simulator to understand the landmarks and aerodrome layout. The airspace is Class D which means there is a higher rate of VFR arrivals to be factored into the arrivals sequence with the IFR arrivals. The candidate is then assessed on two simulator exercises ranging from 75 to 90 minutes, depending on the rating for which the candidate is being assessed. This was originally just one assessment, but the failure rate was high. So, a second opportunity was introduced as a business decision to ensure better value for money as the ANSP paid for the candidate to attend the APC. The assessors are from the training department and have vast experience in training and operational practices. They would assess versus a prescriptive checklist to determine the controller's suitability. The outcomes are not always a foregone conclusion as an ATCO with significant experience from a high-intensity work environment in a different country may not adapt to the high work rate in the UAE. This could be because of a range of reasons, including cultural reasons where the candidate may not adapt to the fast-paced, high-intensity environment. The process is viewed as a good business practice as it results in a higher success rate not only at the Unit Training level but operationally too.

In Europe, EU Regulation 2015/340 does not legislate for Assessment of Previous Competence as a tool for recruiting qualified Air Traffic Controllers. However, some ANSPs use it with specific approval from their competent authority. The Regulation only permits the assessment based on interruption of training or non-exercise of the rating within the same unit. However, it appears that some ANSPs conduct Assessment of Previous Competence with their Competent Authority Approval being given. This will often occur when, like the UAE, Air Traffic Controllers are recruited externally from the ANSP or when recruiting training instructors for the ANSPs training school. This ensures that the ANSP can be confident in the quality of the candidate before employment commences. Within Europe, it may not be a straightforward process and appears to differ with each ANSP. This makes it difficult to ensure a minimum standard is applied when conducting an APC. This impacts the mobility of ATCOs from outside of the EU attempting to gain employment from within the EU. It is a barrier that is not too dissimilar to the various citizenship requirements.

The only solution to this mobility barrier within the EU is for the ATCO to retrain to be brought into the European system. This is a common practice and applies when an ATCO transfers from military to civilian operations. While the content of the training will be identical to the basic training and rating training, the experience of the candidates is taken into consideration. Therefore, a compressed time frame is set for the delivery of the training. While it is a frustrating process for the candidates to satisfy the legal requirements, it is necessary to ensure a successful transfer of the knowledge, skills, and attitude onto a European licence.

EASA (2021) issued the updated European Plan for Aviation Safety (EPAS) which covers from 2022 – 2026. Contained within the plan in volume II section 5.3.6 are some subtasks aimed at maintaining EU 2015/340 resulting from feedback from EU states indicating the need for enhancing and simplifying the ATCO licencing system. Subtask 1 is aimed at, "*introducing a controlled mechanism of crediting of training, experience or other qualifications of military ATCOs for the purpose of obtaining ATCO licences under Regulation (EU) 2015/340*." Subtask 3 is aimed at, "introducing a mechanism for the recognition of third-country ATCO licences under Regulation (EU) 2015/340". This could well be the steps required to address the mobility issues outlined above and potentially formalising in regulation a mechanism such as an APC for ATCO assessment with a new ANSP. It is an interesting development in light of BREXIT and the classification of the United Kingdom as a third-country.

While understandable from one perspective, the citizenship requirements to allow candidates to fall within the civil service system are overly restrictive on ANSPs from recruiting direct entry controllers from outside the State and affect the mobility and interoperability of ATCOs within the aviation system. For example, some ANPS (e.g. Nav Canada and Airways New Zealand) accept permanent residency.

Conclusion

Air Traffic Control Officers are valuable to the ANSPs business and therefore their recruitment and training is important. The recruitment of Air Traffic Control Officers is the responsibility of each State as outlined by section 4.3 of ICAO Annex 1 by stating: "*Contracting States shall take the appropriate measures to ensure that student air traffic controllers do not constitute a hazard to air navigation*" (ICAO, 2020: 102). This is the key piece of regulation that transfers the responsibility for accepting student ATCOs into the aviation system and setting the minimum standard for their acceptance to each ANSP.

For EU states, the incorporation of ICAO Annex 1 requirements into EU 2015/340 has provided some standardisation. The mechanism of supplying additional information through AMCs and GM has been invaluable for ANSPs to provide training to a verified standard and ensure that they comply with the remainder of the EU and contribute to the SES concept. ANSPs and competent authorities are subject to oversight also from EASA through regulation EU 2017/373 to ensure that each State follows the provisions of the various regulations, including EU 2015/340.

Nevertheless, there are variances in recruiting student ATCOs, but they do not differ greatly. The result of the recruitment analysis highlights some states' inefficiency concerning the provision of new ATCOs in good time to manage against staff turnover. The data analysis has allowed the author to determine the preferable elements of the recruitment and training process that should be applied uniformly across all ICAO states. This will ensure that no deficiencies in the recruitment and screening processes occur, leading to any deficiencies within the aviation management system.

Discussion Questions

- What are the main areas for ATCO licencing requirements as outlined by ICAO?
- What are the main ATCO categories?
- What are the competencies for the OJTIs?
- How do recruitment and training differ across various ANSPs around the world?
- What factors act as a barrier for ATCO's mobility, and how?

Acknowledgements: The gathering of the information has been a challenging task. We would like to thank the ANSPs, ATCOs, Training Organisations and Competent Authorities that supported us.

References

- Akyildirim, E., Corbet, S., Efthymiou, M., Guiomard, C., O'Connell, J. F., & Sensoy, A. (2020). The financial market effects of international aviation disasters. *International Review of Financial Analysis*, *69*, 101468.
- Corbet, S., O'Connell, J. F., Efthymiou, M., Guiomard, C., & Lucey, B. (2019). The impact of terrorism on European tourism. Annals of Tourism Research, 75, 1-17.
- EASA, 2022, *European Plan for Aviation Safety (EPAS 2022 – 2026), Volume II – Actions, European Aviation Safety Agency, Cologne, Germany.*
- Efthymiou, M., Usher, D., O'Connell, J. F., Warnock-Smith, D., & Conyngham, G. (2021). The factors influencing entry level airline pilot retention: An empirical study of Ryanair. *Journal of Air Transport Management*, *91*, 101997.
- EC. (2015). Commission Regulation (EU) 2015/340 of 20 February 2015 laying down technical requirements and administrative procedures relating to air traffic controllers' licences and certificates. *Official Journal of the European Union*, *63*, 1-122.
- ICAO, 2016, *Doc 4444 - Procedures for Air Navigation Services - Air Traffic Management*, Sixteenth Edition, International Civil Aviation Organisation, Montreal Canada.
- ICAO, 2018, *Annex 11 - Air Traffic Services*, Fifteenth Edition, International Civil Aviation Organisation, Montreal Canada.

- ICAO, 2020, *Annex 1 - Personnel Licencing*, Thirteenth Edition, International Civil Aviation Organisation, Montreal Canada.
- ICAO, 2020, *Doc 9868 - Procedures for Air Navigation Services - Training*, Third Edition, International Civil Aviation Organisation, Montreal Canada.
- Ruiz, J. R. (2007). Current trends in air traffic controller recruitment and training. *Journal of Aviation/Aerospace Education & Research*, *16*(2), 4.
- Ruiz, J. R., & Ruiz, L. E. (2003). Collegiate Aviation and FAA Air Traffic Control. *ATEA Journal*, *30*(3), 12-15.
- Warnock-Smith, D., Graham, A., O'Connell, J. F., & Efthymiou, M. (2021). Impact of COVID-19 on air transport passenger markets: Examining evidence from the Chinese market. *Journal of air transport management*, *94*, 102085.
- Wickens, C.D., Mavor, A.S and McGee, J.P. (1997). *Flight to the Future, Human Factors in Air Traffic Control*. Washington: National Academy Press.