DEVELOPING EFFECTIVE AVIATION FAMILIARIZATION AND ADVANCED QUALIFICATION PROGRAMS FOR NON-OPERATIONAL PROFESSIONALS

by

Aline Maia
Bruna Ferreira da Silva
Eduardo Marchezin
Juliana Melfa
Marcus Navi

This Capstone Project was prepared and approved by the Group's Capstone Project Chair, Dr. Robin Roberts

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Capstone Project Chair
Dr. Robin A. Roberts
Associate Professor, Worldwide College of Business
Department of Management and Technology

Embry-Riddle Aeronautical University
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Abstract

This research suggests extending the Advanced Qualification Programs (AQP) for operational indirectly related professionals. Thus, contributing to improve quality, safety, and security processes practiced daily in this industry. Aviation today has an AQP dedicated to professionals working directly on flight operations. This, over time, has proved to be an efficient strategy for reducing incidents and accidents. The program seeks improvement through constant updates of technological innovations available to the sector. However, the program mainly dedicated to pilots doesn't apply to other operations back-office professionals. The training of these workers is primarily individualized with no standard processes of each airline. Thus, the AQP effectiveness is analyzed through case studies contrasting impacts on safety and security.

Keywords: AQP; Advanced Qualification Program; training; non-operational aviation training.

Introduction

The aviation industry is a pillar of modern global connectivity, relying on the knowledge and skills of its professionals to ensure safe and efficient operations. Among the various training methodologies in aviation, Advanced Qualification Programs (AQP) have emerged as a successful approach for enhancing pilot training, leading to a significant reduction in incidents and flight accidents. The effectiveness of AQP is evident, as it fosters continuous improvement through the integration of technological innovations, updated methods, and equipment for pilots' training. However, the scope of AQP was originally developed around flight operations, leaving a noticeable gap in extending these benefits to non-operational professionals who indirectly influence the success of aviation operations.

The work presented in this capstone project aims to address this gap by presenting strategies for the development of a comprehensive methodology that extends the benefits of AQP to other professionals working in aviation with an indirect relationship to flight operations. By doing so, this research seeks to contribute to an improvement in the quality, safety, and security processes practiced daily within the aviation industry. These non-operational professionals play critical roles in ensuring seamless aviation operations and equipping them with the right training and qualifications is imperative.

Relevance of the Study Topic

The extension of Advanced Qualification Programs to non-operational professionals is highly relevant and significant to the aviation industry's overall efficiency and safety. By providing standardized training processes and competency-based assessments for these crucial roles, the industry can enhance the skills and knowledge of non-operational personnel, ultimately influencing the quality of aviation services. A well-developed methodology for

aviation familiarization and Advanced Qualification Programs can lead to increased confidence and competence among practitioners, improve organizational performance, and positively impact the field of aviation studies.

Justification of Research Knowledge Gap

The existing knowledge gap in research is evident in the limited application of AQP principles to non-operational professionals in the aviation industry. While extensive research and successful implementations of AQP for pilots have been documented, little attention has been given to adapting and implementing these principles for non-operational roles. This research seeks to fill this gap by presenting a comprehensive methodology that addresses the specific training needs and challenges faced by non-operational professionals, contributing to the aviation development.

Research Problem Justification

The core research problem of this capstone project centers on the investigation and development of effective aviation familiarization and Advanced Qualification Programs (AQP) for non-operational professionals. This research problem holds significant importance as it seeks to bridge the training disparity among aviation professionals, ultimately benefiting stakeholders across the industry. By equipping non-operational personnel with the required skills and knowledge through AQP, potential risks can be mitigated, operational efficiency enhanced, and safety measures strengthened. Moreover, this research also addresses a critical aspect of the aviation industry: the challenges posed by the rapidly growing sector and the retirement of experienced aviation professionals.

As the aviation workforce experiences accelerated growth and transformation, ensuring an effective aviation familiarization and AQP program for non-operational professionals

becomes vital in securing a seamless transition of knowledge and expertise. The retirement of experienced aviation professionals can lead to knowledge gaps and skill shortages, making it crucial to equip the newer generation of professionals with comprehensive and tailored training. By doing so, the industry can uphold its high standards of safety and operational efficiency, even amidst workforce changes. Thus, the resolution of this research problem not only enhances the capabilities of non-operational professionals but also proactively addresses the industry's evolving workforce dynamics, ensuring continuity and success in aviation operations.

Purpose of the Study

The primary purpose of this capstone project is to develop a comprehensive methodology that extends AQP principles to non-operational professionals, elevating their competence and performance. Through this research, we aim to achieve the following objectives:

1. Analyze existing Advanced Qualification Program (AQP) implementations in pilot training and evaluate their impact on safety and operational practices.
2. Identify the training needs and challenges of some non-operational professionals who indirectly influence aviation operations.
3. Develop a comprehensive and adaptable methodology for extending AQP principles to non-operational roles within the aviation industry.
4. Assess the effectiveness of the newly designed aviation familiarization and AQP through practical case studies and stakeholder feedback.

Research Questions

To address the research problem and achieve the defined objectives, this project seeks to answer the following research questions:

1. How can the successful principles of Advanced Qualification Programs (AQP) in pilot training be adapted and extended to enhance the training and qualifications of non-operational professionals in the aviation industry, particularly with a focus on safety and security practices?

2. What are the specific training needs and challenges faced by non-operational professionals who indirectly influence aviation operations, and how can AQP be tailored to address these unique requirements?

3. What methodologies and strategies can be formulated to implement the extended aviation familiarization and AQP, and how can their effectiveness be evaluated through practical case studies and stakeholder feedback?

Theoretical or Conceptual Framework

The theoretical framework for this research draws from the foundations of AQP principles, adult learning theories, and best practices in training and development. Insights from related industries, such as healthcare and the military, where AQP-like programs have been successfully implemented, will also be considered to inform the development of a tailored approach for non-operational professionals in aviation. This framework provides a solid foundation for the research and aligns with the defined research questions, ensuring a comprehensive and cohesive study.

Nature of the Study

This capstone project will employ a qualitative research method. A comprehensive literature review will be conducted to explore the existing body of knowledge related to AQP, aviation training, and non-operational roles. Surveys and interviews with aviation professionals and stakeholders will provide valuable insights into the training needs and expectations of non-

operational personnel. Practical case studies will be utilized to evaluate the effectiveness of the proposed aviation familiarization and AQP programs. This approach will contribute to an understanding of the research problem and facilitate the development of comprehensive solutions.

Problem Statement

The central research problem of this capstone project centers on developing effective aviation familiarization and Advanced Qualification Programs (AQP) customized for nonoperational professionals. The project aims to explore and implement a tailored approach to train and qualify these individuals within the aviation industry. Despite their vital contributions to flight operations, existing training programs have not sufficiently catered to their specific requirements. By answering the research questions, this project aims to contribute to a comprehensive approach that equips non-operational professionals with the necessary skills and knowledge, ultimately enhancing aviation operations and safety.

Definition of Terms

Advanced Qualification Training (AQP): Voluntary and data-driven training system developed using a systematic training program methodology. Consists of an alternative means of compliance to the 'traditional' regulatory requirements under 14 CFR Parts 121 and 135 for training and checking (Federal Aviation Administration, 2022).

Evidence Based Training (EBT): Pilot training concept centered around competency-based training principles. The evidence for this program comes from analyzing accident and incident data to identify the competencies that a pilot requires to operate the aircraft safely and efficiently (UK Civil Aviation Authority International, 2021).

Safety Management System (SMS): A term used to a formal, top-down, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls. It includes systematic procedures, practices, and policies for the management of safety risk. (Federal Aviation Administration, 2022b).

SWOT Analysis: "SWOT" stands for strengths, weaknesses, opportunities and threats. It´s a planning process technique that helps organizations overcome challenges and determine which new leads to pursue (Business News Daily, 2023).

List of Acronyms

AI……..Artificial intelligence

AMM……Aircraft Maintenance Manual

CMM…….Component Maintenance Manual

ANAC…...National Civil Aviation Agency

AQP……..Advanced Qualification Training

AQuA……Advancing Quality Alliance

CENIPA…Center for Investigation and Prevention of Aeronautical Accidents of the Aeronautics Command of the Brazilian Air Force

CREA……Regional Council of Engineering

CFR……...US Code of Federal Regulations

CRM……..Crew Resource Management

EASA……European Union Aviation Safety Agency

EPA…….. Environmental Protection Agency

FAA……..Federal Aviation Administration

FPA……...Financial Planning and Analysis

GSE……..Ground Support Equipment.

IATA…….International Air Transport Association

ICAO.....International Civil Aviation Organization

IDPs……...Individual Development Plans

IPC…….Illustrated Parts Catalog. A document to the Aircraft Maintenance Manual (AMM)

KPI……Key Performance Indicator

LCSA……Line Check Safety Audit

ML……Machine Learning

MS……Microsoft

MRO……..Maintenance Repair Overhaul

OEM……..Original Equipment Manufacturers

OSHA……Occupational Safety and Health Administration

RBAC……Regulamento Brasileiro de Aviação Civil. Brazilian Civil Aviation Regulation

SFAR…….Special Federal Aviation Regulation

SI……Supplementary Instruction

SRM……...Structural Repair Manual

SIPAER.....Sistema de Investigação e Prevenção de Acidentes Aeronáuticos. Aeronautical Accident Investigation and Prevention System

U.S.....United States

Methodology

The study presented here proposes its development from a qualitative interviewing approach. This stage proposes conducting case studies to understand the development and

implementation of AQP training. We´ll analyze the methods, the content relevance, and the approach to carrying out the training. A contrast of the employee's perception of going through the process will also be explored. Then the evolution of this method over the last 20 years will be investigated. In the quantitative stage, the outcomes of implementing the new training method will be investigated. The case study will be based on the qualitative analysis. Operational performance, safety, and quality indicators will be compared through conventional versus AQP methods.

The qualitative phase encompasses three stages. First, a case analysis: The training implementation records for professionals in areas related to the operation will be evaluated. An implementation analysis will be covered at the Brazilian Azul Airlines. The scope will present the proposed objectives, their content and the training method adopted. The target public profile, the tools used, and the duration will also be explained.

Second, interviews with specialists on a previously implemented training program: We'll conduct interviews with the leaders of training in the main airlines. Then we´ll interview leaders of areas whose extension of the AQP training is being proposed. This will underscore the demands, critical points, and their perception of the proposed method. It will include their perceptions and expectations that should be addressed in this work.

Third, interviews with employees: Discussion groups with different hierarchical levels in areas where the AQP extension method is intended. Thus, we´ll gather their perception regarding the knowledge necessary for the development of their activities. This approach will be conducted in terms of safety, operational processes, and service quality. Discussions will be guided from open-ended questions to encourage in-depth responses.

Quantitative data will be collected from the professionals for whom the training is intended. Initially quantifying them by gender, age group, hierarchical level, and time in the profession. Regarding engagement of professionals, it will be analyzed in terms of training time. Also, in terms of area of expertise courses taken, and investment in their qualification.

The obtained results will include data on operational performance indicators. This data will be analyzed to assess its impact on operational outcomes. Subsequently, a thematic data analysis will be conducted where the cases analyzed will be transcribed. The analysis will underscore the methods adopted and the content applied. This characteristic aims to identify the components of greater relevance of the research problem.

Research Process:

Informed consent: All participants and companies will be provided and informed consent before participating in the study. This will ensure that they understand the purpose, procedures, and potential risks involved. Additionally, it will uphold ethical standards throughout the research process.

Confidentiality: Participant identities such as the companies' names will be kept confidential. Also, all the data collected will be anonymized during analysis and reporting. It will safeguard sensitive information and protect the participant's privacy, organizations, or any entities involved.

Sample size: The study will be developed from the analysis of one case of AQP implementation. This will be compared with a minimum of two scenarios. We will manage to contrast the models and create a comparison of each method. These two scenarios will be: 1) The use of training in alternative methodology, and 2) the absence of training for professionals in areas related to the operation.

Time Restrictions: The study focuses on evaluating case studies of training implementation results from the last five years. Furthermore, cases with implementations completed in less than one year will be excluded. It is to ensure a comprehensive evaluation of the company's results and outcomes. These restrictions are in place to maintain the validity and relevance of the study's findings.

As previously mentioned, we'll use a mixed methods approach. Thus, we´ll provide a comprehensive understanding of the strategies for implementing AQP training. We´ll also discuss the expected results of this methodology. These analyses seek to obtain relevant data for the composition of an important guideline: The effective extension of the AQP to non-directly operational positions.

Data Analysis

In developing this work, we aim to back the topic's justifications with supporting data. Also, we´ll seek to understand the training needs for professionals indirectly related to the operation. We´ll explore the content required, training methodologies, and assess gains from training the target audience. A deep dive into relevant aspects around the topic will be conducted. Therefore, an extensive literature search was carried out based on existing articles and publications. Data from Science Direct, Web of Knowledge, Elsevier and the Hunt Library databases was analyzed. We seek a sample data space covering the last 5 years. From this research, the 30 main articles were chosen for theoretical foundation. A detailed analysis of this data will be presented below.

General Context

Aviation is a paradox of being considered the safest means of transport in the world. The fear of flying factors, often outweighs safety concerns, influencing people's imagination and user

perception. Continuous commitment to enhancing regulations led to a declining trend in fatal air accident rates. Continuous improvement in training practices, aircraft manufacturing advancements, and technology all played key roles. Although accident rate decreases, the main industry goal is to achieve zero accident rate.

The air transport market in Brazil has always faced strong volatility. Historically, the aviation industry presents high risks, large investments, and low profitability. Understanding the business environment, and proper strategies are necessary for success in a competitive sector.

Throughout history, Brazilian airline pilot training programs consistently adhered to stringent regulatory requirements. This, however, fell short in addressing the particularities of their operations. Over time alternative training programs have emerged, but few airlines have adhered to new methodologies.

This is explained by the need for a higher initial investment, required by these programs. A conservatism of the sector is also a characteristic. There are some regulatory obligations, necessary for companies to implement an Operational Safety Management System. Professional training is viewed as vital to improving quality and ensuring an acceptable safety level.

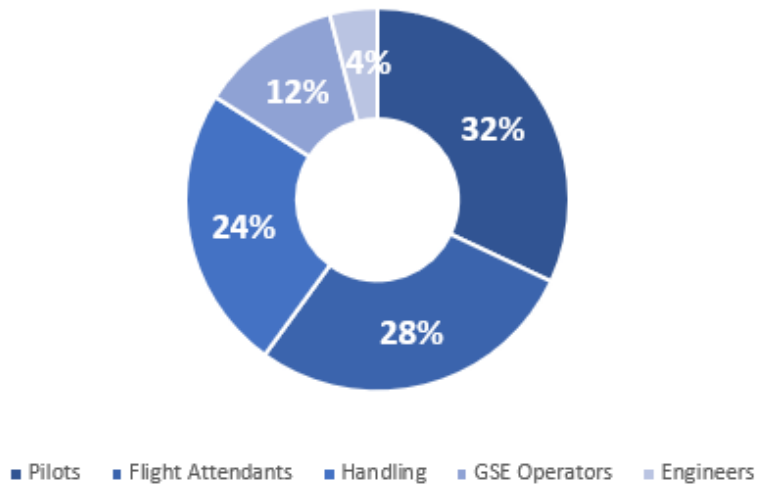
Characterization of the target audience

The Brazilian Aviation Institute's 2023 Aviation Yearbook states that the Brazilian airline market currently has: 15,232 pilots, 13,342 flight attendants, and 11,659 ground flight handlers. Cleaning and GSE operators have 5,938 and engineering, indirectly related to flying, has 2,061 employees.

Of 15 main functions in aviation, 3 are administrative and 5 are indirectly operation related. The training of this staff is provided by regulatory agencies. Except for pilots and flight attendants, all other employees are indirectly related to the operation. There is no mandatory

training program provided by any regulatory agency, whether national or international. Of these, the role of loader in some regions of the country has more employees than pilots and flight attendants.

Figure 1: Professionals in Brazilian Aviation



Incidents and accidents related to the target audience.

In Brazil, aeronautical accidents and incidents in the national territory data are centralized at CENIPA. This data includes aircraft-involved information and meteorological conditions at the time of the accident. It also includes information about human factors, potential contributors to the event, and infrastructure conditions.

The number of occurrences in the last 5 years has been influenced by global pandemic. Nevertheless, SIPAER's data indicates "ground operations" and "aerodrome conditions" as the main occurrences causes. The target audience of this study has functions directly related to these categories. Additionally, by performing cause-specific analysis, the following data were obtained:

Table 01

Accidents and incidents related to indirect related professionals in 2023

Cause	serious accidents	serious incidents	Incidents	fatalities
Infrastructure and engineering	58	21	5	6
Incursion	7	9	30	1
Ramp and handling	3	0	15	1
Total	**68**	**30**	**50**	**8**

Note. This table presents data related to accidents and incidents on CENIPA's database for the last year.

These numbers underscore the relevance of including operation indirectly related professionals in regular training methodologies. This approach guarantees their commitment to the safety of such a critical operating market. IATA records approximately 7,000 ramp accidents and incidents globally each year. This equates to one occurrence per 1,000 departures as cited by Bin Saeed Al Maktoum, A. (2021).

These incidents result in around 243,000 annual injuries. It represents an injury rate of about 9 per 1,000 departures. This highlights the importance of updating training programs for ground staff at all airports. Despite aviation's increasing automation, human operators remain crucial in ensuring safety on the ground.

Esser (2006) examined LCSA data in the AQP's training in Threat and Error Mitigation context. He found that Ground Operations had the highest frequency of threat events. This reinforces the need for specific training in this area.

Training the ground

In the "Training and Development," article, Biech (2022) highlights the importance of a strong learning culture. This connects learning perception with organizational values for effective talent development. The author further asserts that nurturing a culture of learning in aviation

brings several benefits. These benefits include increased competitiveness, higher employee engagement and commitment to safety. Also, a more effective approach to talent development can result of this culture.

"Learning Organization and Work Engagement" article (Malik & Garg, 2020) also connects with our topic. They explain the relationship between organizational learning and employee resilience and engagement. They contrast it to the context of contemporary organizations facing digital transformations and increased competition. They aimed to examine how fostering a culture of organizational learning can impact employee resilience. It influences work engagement and safety commitment, a critical factor for aviation operations. The challenge becomes reinforcing a culture of learning that extends beyond pilots and flight attendants. It would address positions of risk that, in recent years, acted counter to safety.

Regulatory aspects of training

Historically, airlines are regulated with requirements to training programs, established by the aeronautical authority. In Brazil, ANAC (National Civil Aviation Agency) is responsible for controlling this regulation. In the USA this responsibility is owned by FAA and in Europe by EASA. The training curriculum is not customized according to the particularities of each airline. They are regulated without distinction of company size, aircraft fleets, routes flown or operational characteristics.

They follow specific workloads, generic content and focus on the individual skills of the pilots. Their technical proficiency is carried out without emphasis on non-technical skills. Legislation while the legal framework, must be anchored in an acceptable level of safety performance. The training of pilots was modified over time. Mainly, due to the lack of non-

technical skills of the crew that contributed to accidents. Human failures must be addressed and remedied to meet new demands and technological developments.

Mandatory training by ANAC

The Brazilian training program is stipulated in the RBAC 121 and Supplementary Instruction (SI) 121-007B. It includes non-personalized training with set hours and generic content, designed for air operations professionals. It is customized to match each airline's specific operation needs.

These training sessions vary depending on the category and role of the professional.

For Pilots:

Initial Training: To obtain a pilot license (private, commercial, or airline transport), pilots must undergo initial training. It will include theoretical classes and practical flight hours.

Type Rating Training: Pilots who wish to operate specific aircraft must undergo type rating training. It is to familiarize them with the aircraft's features and systems.

Recurrent Training: Pilots must undergo periodic training to maintain their skills up to date. It ensures they are aware of the latest regulations and safety procedures.

For Flight Attendants:

Flight Attendant Training Course: This course covers aspects such as safety, first aid, evacuation procedures, and customer service.

Recurrent Training: Like pilots, flight attendants must undergo regular training to update their skills and knowledge.

For Mechanics and Maintenance Technicians:

Technical Course: Mechanics and maintenance technicians must obtain technical certificates after completing a recognized course.

Manufacturer Training: Professionals involved in the maintenance of specific aircraft often undergo training offered by manufacturers. It is to ensure they are updated with modern aircraft systems.

For Air Traffic Controllers:

Specific Course: Air traffic controllers undergo specialized training to learn about air traffic control procedures. This ensures the safety of air operations.

Continuous Training: They participate in regular training to stay updated with the latest protocols and technologies.

These trainings are regulated without distinction regarding company's size, aircraft fleet, routes, or operational characteristics. It follows specific hours and generic content that focuses on the individual crew member's competencies. Their technical proficiency is also carried out, without emphasis on non-technical skills.

In cases involving indirect operations-related personnel, there is no standardized training for ground staff. This includes ramp agents, operational dispatchers, engineers, and airport logistics staff. The training of these professionals is delegated to airline companies and operators. Specialized companies in airport operations training are also often subcontracted by the airlines. Since not mandatory, this training doesn't always effectively address the critical aspects of the operation.

Mandatory training by IATA and FAA

IATA and FAA establish standards and regulations for the civil aviation industry. But they do not necessarily prescribe specific training. Instead, they provide guidelines and general requirements that airlines and aviation organizations must adhere to. Aviation authorities in different countries, often adapt these guidelines into their own specific regulations. They adapt

the IATA/FAA requirements for operators and aviation personnel. Therefore, mandatory training can vary depending on the country, airline, or aviation organization.

Transition to AQP Competency Training

Traditional pilot training seeks to ensure an acceptable level of operational safety performance. It is based on the practice of abnormal or emergency maneuvers. This does not necessarily represent the reality of daily air operations. Regulation alone is not designed to restrict the evolution of operational training. It only aims to point out the minimum requirements for a training program to be accepted. The civil aviation authority must also approve this program. Given the few training hours compared to annual pilot flight hours, prioritizing quality is fundamental. AQP is an alternative methodology to develop customized content for the airline crew member's training.

The competency training methodology is a sample of improving the safety level. It seeks the correct compliance by pilots of actions based on operational discipline. It is the basis for mitigating undesirable occurrences, such as incidents or aeronautical accidents. The requirement for pilot training customization comes from the demands required by new technologies introduction. The diversity of aircraft fleets in the same company is another factor in training customization. Also, the sophistication of the air operation globally, also demands for modernization in the methodologies. A proactive approach it's essential to manage qualification curricula for initial, recurrent, and requalification training.

From data collected from the operational environment, systematic analysis, innovations, and self-corrections are carried out. The main objective is the construction that will show if AQP adoption is feasible. It can be adopted in all or only a part of its fleet. It also contributes to the deeper understanding of AQP by the Brazilian civil aviation community.

AQP enables more appropriate management of operational training by approaching air operations. Through more realistic scenarios, it enables a more real reading. The method is based on the crew's daily lives, not prioritized in traditional programs. The collection and diagnosis of information provide the development of a database. This database is an important tool to indicate trends and signal significant operational problems. The program seeks to meet the changes in the aeronautical industry. Changes such as new embedded technologies and modifications in operational environments. It also aims to achieve a high standard of individual and team performance. It looks both to technical skills and those related to cabin management (CRM).

It is known that AQP enables an increase in the quality of pilot training. This is due to correcting deficiencies presented in the traditional program and operational cost reduction. AQP is still little used in fleets of the regular air transport companies of Brazil. This may be associated with the lack of tools to assist the airline’s training program. The search for alternative pilot training methods indicates the limitations of the traditional program. New methods are crucial in developing new skills currently needed. It demands the need for a new structured path to achieve excellence in operational training.

AQP Methodology

The training of pilots was modified over time. Mainly, due to the lack of non-technical skills, that is, human error (Abreu Junior, 2020). AQP was introduced to the industry in 1990 under the SFAR 58. Later, in 2005, it was codified in the 14 CFR Part 121 Subpart Y FAA. The AQP is an alternative training and certification framework in the aviation industry. AQP is designed to replace traditional regulatory requirements under 14 CFR Parts 121 and 135. It allows training and checking with a more flexible, data-driven, and performance-based approach.

This stands for a concept of train-to-proficiency, incorporating scenario-based training and evaluations.

Additionally, it replaces the current system of scheduled hours with proficiency-based training and assessments. This system is derived from detailed descriptions of crew roles in normal and abnormal situations. This ensures a focus on their technical and non-technical skills (Crew Resource Management, CRM).

Benefits and Challenges

AQP encourages innovative training methods and technology, promoting customization of content to individual company needs. It has been instrumental in driving data-based improvements and flexibility in the program as reported. Longridge's research titled "Overview of the Advanced Qualification Program" (1997) reinforces what is AQP. It is not a mandatory certification program. AQP is a voluntary alternative to traditional regulatory requirements for pilot training and checking.

The main goal of AQP is to enhance aviation safety through improved training and evaluations. It allows adapting to changes in aircraft technology, operations, and training methodologies. Therefore, it aims to achieve the highest possible standard of individual and crew performance. This contributes to reducing the probability of human errors. It reacts to the shift in accident indicators from technical to human factors (Abreu Junior, 2020).

Among the advantages of the method is content customization. Then, the use of data to assess cognitive and technical skills. The method also allows the organization to drive statistically demanded improvements. Another relevant advantage is the regulatory flexibility in approving innovative training programs. These characteristics encourage organizations to depart from traditional training practices based on operational requirements.

The AQP makes it possible to substitute scheduled hours for training, based on proficiency. The AQP seeks to reduce the likelihood of crew mistakes putting instructors closer to their causes. It is possible by using training based on real flight scenarios of each operator. Innovation and flexibility help to reproduce the dynamics of aerial activity.

The program aims to improve the proficiency performance of pilots. This is made through ongoing training and assessment of individuals and crew. The method doesn´t allow next-stage advancement unless pilots meet the required standards and competencies. For passing they must also demonstrate proficiency, which tests both technical and CRM skills. The AQP includes high standards of training and improved crew performance. Its implementation allows airlines to customize their own training program with their needs and requirements.

Characteristics of the AQP

The main features presented in this training program are:

- AQP is data-driven for feedback. The collection and analysis of training information allow the creation of a database. This is an important tool to optimize, indicate trends and signal significant operational problems. There is a need for database development and maintenance to meet training requirements.
- More qualified instructors and examiners. They are the backbone of the program. Subjected to a rigorous training process to develop their skills. Skills of instruction, facilitation, and examination, both in real flight and in simulators are considered.
- Training and examinations shall be based on actual scenarios, customized according to the company's operations. One motto of the program is "fly as you train and train as you fly".

- AQP shall train and assess pilots to integrate technical and CRM skills.
- Replaces scheduled hours with proficiency. Based on the quality rather than the number of planned hours from traditional programs. The assessments are based on the skills of the pilots.
- Positive perception of the aeronautical authority and the pilots. It is a factor that assists in the development, certification, and application of the AQP.
- Need for development and approval of extensive documentation. The AQP must comply with all legal requirements of traditional training. Still requires the approval of many documents by the aeronautical authority.
- Demand for behavioral change. It requires breaking paradigms and the need to adapt to a new training methodology.
- The implementation of the FPA requires an initial investment in people and financial resources. There is the team of specialist's cost. Commonly they are experienced commanders in the fleet of aircraft. They need to be dedicated to the preparation of documentation and development of manuals. It also requires a contribution to the training of instructors and examiners. Also, the allocation of financial investments in the company's business plan will be needed.
- Use of financial resources more efficiently. AQP allows, instead of following a fixed cost, as traditional programs, to adapt the format. Airlines can reduce the number of hours, change devices and the number of students. They can also adapt the number of simulator sessions and change the frequency of training. With this, it is possible to have a reduction in costs. This way, they will be still allied to the training of equal or superior quality.

- AQP allows regulatory flexibility. Traditional programs don’t allow airlines to meet training requirements in an alternative way.

These differentiators are feasible as they allow the FAA to approve deviations from traditional requirements. It is possible due to equivalent or better safety level maintained through the AQP. It is demonstrated through monitoring of crew's technical and cognitive skills. A significant percentage of large and medium-sized Part 121 operators in the USA utilize AQP. This includes most major U.S. airlines and an increasing number of regional airlines. Smaller operators typically opt for traditional training.

Financial Aspects

The primary obstacle for some U.S. airlines in joining AQP was the substantial financial requirement. Beginning AQP demands a financial investment in team training, documentation preparation, and manual development. A team of specialist commanders, responsible for implementation represents a relevant cost.

In the case of pilot training, there is also the expense of flight simulator sessions. It includes the allocation of productive days of instructors and examiners. Finally, the cost for the creation and maintenance of the program database is foreseen. But in the case of non-operational staff, simulator sessions will not be a cost barrier.

In contrast, the AQP implementation enables airlines to approve alternative curricula for regulatory requirements compliance. On the other side, adaptation of cost allocation is a tool when needed. When we translate this to ground operations AQP shows some advantages. Adapting set hours can afford the effort redirection to the main topics demanded by the operation.

Future of the methodology

The aviation industry constantly evolves, demanding swift adaptation to new technologies and working methods. Staying current and agile is a top sector priority. The current methodology of AQP for airline pilot training can also consider future trends. This requires compatibility with new technologies such as AI and ML (Herr, 2021). The author emphasizes how AQP, introduced in 1991, aimed to enhance training safety through innovative methods. Today, with all the new technologies available, they can be utilized in curriculum development.

The author suggests that AI and ML could enhance data analysis in AQP. It can help especially in pilot performance evaluation and curriculum development. These technologies have the potential to provide more comprehensive and unbiased insights into training data. However, she also highlights ethical and cybersecurity concerns that need to be addressed.

Decision-Making on AQP

There are any references in the scientific literature regarding the AQP effect on decision-making. Jung (2021) structured a theoretical framework about it and compared traditional pilot training to AQP. He aimed to contribute to a deeper understanding of the unprecedented program in Brazil. This study provides a deep analysis of the AQP to the Brazilian civil aviation community. Through a formal analysis, he justifies a support structure development to receive the program. He conducted a SWOT analysis, personalizing the decision by each airline. This way, he opened a path that can help each company to study the possibility.

If decided to implement the AQP Method, the company must go through a **five-phase process**. These five topics carry out its development, implementation, and maintenance. It aims to ensure that airlines are familiar with the program's obligations and responsibilities.

The phases are as follows:

1. The application.

2. Curriculum development.

3. Qualification of instructors and examiners.

4. Initial Operation.

5. Continued operation.

Jung (2021) emphasizes the importance of a reliable decision-making process to achieve AQP's core goal: Allow similar training from pilots to all operation professionals. It will help on increase operational safety and reduce industry incidents and accidents.

Project Outcomes

Data analysis reveals aviation safety and efficiency rely on professionals' skills and knowledge. It is true whether these professionals are directly active in the operation or not. AQP improved pilot training but extending benefits to other professionals remains challenging.

The analysis also highlighted the initial steps and guidelines required for the implementation of training. Therefore, at in-depth case study at Azul Airlines the various training stages implementation was enlightening. Also, a survey with LATAM Airlines was conducted to show an AQP training implementation result.

Application of AQP in Azul Airlines' Technical Support Engineering Department

In the study conducted, three stages illustrate the process of implementation of the training. These stages were: Characterization of professional requester, development of training, and monitoring of training and analysis of results data. Handling and engineering professionals are highly relevant in the operational safety context. Thus, this chapter explores the AQP principles application in Azul Airlines' Technical Support Engineering Department. This area was chosen for further study and we´ll address specific training needs and challenges. We´ll discuss the outcomes regarding strategies in line with the methodology specified for this study.

The goal is to bridge the training gap among aviation professionals, facilitating knowledge transfer.

Job Analysis for Azul's case study

To develop the case study, a comprehensive Technical Support Engineer role Job Analysis was conducted. This included an examination of aspects like basic functions, scope, tasks performed, and responsibilities involved. Additionally, critical soft skills like decision-making authority, communication, teamwork, adaptability, and 3 problem-solving were scrutinized. It helped in defining the necessary educational and training requirements for effective job performance. The description of the professional whose the training was based is seen below.

- **Job title:** Senior Technical Support Engineer
- **Department:** Engineering
- **Reports to:** Engineering Manager
- **Basic functions and scope of the job:**
    - Ensure continued airworthiness of aircraft. How: By providing technical support during aircraft maintenance in hangars and components in workshops.
    - Develop engineering technical documentation for aircraft and component maintenance and repairs. It ensures the commitment to aeronautical certification requirements and internal policies.
    - Consult with Original Equipment Manufacturers (OEMs) to develop repair and technical maintenance solutions.

- Coordinate the development of Ground Support Equipment (GSEs), tools, and workshops. This ensures compliance with certification, safety, and liability requirements.
- Prepare budgets for the engineering area.
- Create and maintain up-to-date internal engineering procedures.
- Implement technical improvements in area processes and interfaces.
- Conduct external and internal technical training, evaluating training outcomes.

Work Performed

Table 2

Duties, Responsibilities and Frequency proposed for the job position of the case study

Duties	Description	Why/How	Frequency
Provide technical support during aircraft maintenance	Offer technical assistance to aircraft undergoing maintenance in hangars and components in workshops.	Ensure continuous airworthiness and safety by troubleshooting and resolving technical issues during maintenance procedures.	Daily
Develop engineering technical documentation for maintenance and repairs	Create engineering technical documents to guide maintenance and repair tasks, adhering to certification requirements and internal norms.	Ensure standardized procedures are followed, and safety standards are met during aircraft maintenance and repairs.	As needed
Consult with OEMs for technical maintenance solutions	Collaborate with Original Equipment Manufacturers	Access specialized knowledge and resources from OEMs to address complex	As needed

Duties	Description	Why/How	Frequency
	(OEMs) to develop effective repair and maintenance solutions.	technical challenges in aircraft maintenance.	
Coordinate the development of GSEs, tools, and workshops	Manage the development of Ground Support Equipment (GSEs), tools, and workshops to meet certification, safety, and liability requirements.	Ensure the availability of reliable equipment and tools to support efficient and safe aircraft maintenance operations.	As needed
Prepare budgets for the engineering area	Develop and plan budgets for the engineering department's activities and projects.	Ensure optimal allocation of resources and financial planning to support engineering initiatives.	As required
Create and maintain internal engineering procedures	Establish and update internal engineering procedures to ensure adherence to best practices and regulatory requirements.	Streamline workflows, enhance efficiency, and maintain compliance with industry standards in engineering processes.	Ongoing (continuously)
Implement technical improvements in processes and interfaces	Identify areas for improvement in engineering processes and interfaces and implement enhancements.	Enhance operational efficiency, optimize workflows, and ensure continuous improvement in engineering operations.	Ongoing (continuously)
Conduct external and internal technical training	Deliver technical training sessions to external and internal stakeholders,	Disseminate knowledge, enhance skills, and foster professional development among	Periodically

Duties	Description	Why/How	Frequency
	evaluating training outcomes.	team members and stakeholders.	

Work Contacts

Table 3

Communication matrix proposed for the job position on the case study

Contacts	Frequency	Purpose of Contact	Means of Contact
Immediate Peers	Regular	Exchange information, coordinate work	Meetings, emails
Peers in other depts.	Occasional	Collaborate on cross-functional projects	Meetings, emails
Immediate Manager	Regular	Report work progress, seek guidance	Meetings, emails
Managers other dept.	Occasional	Collaborate on interdepartmental projects	Meetings, emails
Executives	Infrequent	Present project updates, seek approvals	Meetings, emails
Customers	Infrequent	Provide technical support and information	Meetings, emails
ANAC/FAA/EASA	Occasional	Collaborate with external stakeholders	Meetings, emails

Decision-making Authority

The Senior Technical Support Engineer operates with a moderate level of autonomy. This is structured within the framework of company policies, procedures, and practices. They are empowered to make decisions related to technical support during aircraft maintenance. They also help develop engineering technical documentation and coordinating GSEs, tools, and workshops. These decisions are expected to align with established guidelines, safety protocols, and regulatory requirements.

The Senior Technical Support Engineer has the authority to make day-to-day decisions. These decisions are within their area of expertise. Major decisions, especially those with significant implications or budgetary impact, may be subject to review. Commonly in this case, it goes to the Engineering Manager or higher-level executives for approval.

The position requires exercising sound judgment, technical expertise, and adherence to industry best practices. It is important to consider the safety, airworthiness, and efficiency of aircraft maintenance operations. The engineer is expected to collaborate and seek guidance from peers, managers, and cross-functional teams. It ensures well-informed decision-making.

Overall, the Senior Technical Support Engineer has the authority to make critical decisions. These decisions are related to technical support and engineering processes. This professional needs to guarantee operational parameters of company policies, procedures, and practices. It is needed to aim to maintain high standards of safety and efficiency.

Supervisory responsibility

The Senior Technical Support Engineer does not have direct supervisory authority over other employees. However, they play a crucial role in sharing knowledge and disseminating expertise through team members. Although not having managerial responsibilities, the engineer

is expected to actively engage in knowledge exchange. Supporting the professional development of peers and less experienced team members is highly expected.

- **Physical effort:** minimal physical effort involved. Mostly sitting and walking.
- **Tools, equipment, and/or machinery used:** Computers, office equipment.
- **Work conditions:** No adverse work conditions.
- **Education and training required:** Bachelor's Degree in Mechanical Engineering, Aeronautical Engineering, or Mechatronics. Active CREA. Advanced or Fluent English proficiency. Knowledge of aircraft manuals (AMM, IPC, SRM, CMM, etc). Familiarity with aviation regulations (ANAC, EASA, and FAA). Proficiency in MS Office, especially Excel.
- **Years of experience:** minimum of 10 years of previous experience is required for performing the job.
- **Other requirements:**
    - Knowledge of Airbus A320/A330, ATR72-600, Embraer 195, Embraer 195-E2, or Boeing 737-400 aircraft.
    - Experience in demonstrating compliance with regulatory requirements (ANAC/EASA/FAA).
    - Aircraft Environmental Control System Knowledge (temperature, humidity, pressurization, ventilation, air filtration, smoke control system, etc.).
    - Aircraft Mechanical and Hydraulic Systems Knowledge (landing gear, control/steering/braking systems, and other components).

- Aircraft Flight Control Systems Knowledge (flight surfaces, ailerons, elevators, rudder, spoilers, stabilization, and compensation systems).

Background of the environment for the case study

Azul Airlines faces unique challenges in its Technical Support Engineering Department. It includes aircraft maintenance, repair, and compliance with regulatory standards. The professionals in this department directly influence aviation operations, making their training crucial. Existing training programs have often been individualized, lacking standardization. The data and capstone study reveal that applying AQP principles can tackle these challenges effectively. This ensures standardized and efficient training.

Methodology of training adopted

The introduction of AQP in Azul Airlines' Technical Support Engineering Department stemmed from initial research. This involved an analysis of ANAC regulations related to aircraft engineering area. This provided guidelines for the development of specific training modules. An Azul Airline’s multidisciplinary team collaborated to design a detailed training program. This team is formed by training, quality, human resources, and engineers team members. This program encompassed theoretical training, hands-on practical sessions, and advanced simulation technologies. The implementation of AQP in Azul Airlines' Technical Support Engineering Department followed a structured methodology:

Research and Initial Planning: Conducted a detailed analysis of ANAC regulations, understanding specific compliance requirements. Established a multidisciplinary team, including instructors, engineers, maintenance technicians, and airline representatives. Defined clear program objectives, emphasizing skill enhancement, skills update, and innovative training methods.

Program Design: Identified key training areas, considering training phases, aircraft types, and operational procedures. We developed a detailed training plan encompassing theoretical modules including in-house training, external training in OEM like Airbus, Boeing, Embraer, and hands-on practical training. Integrated advanced simulation technologies and electronic learning resources for enriched training experiences.

Course Development: Designed training modules based on competencies required for aircraft maintenance engineers. Ensured course compliance with ANAC standards, covering topics: specialized aircraft systems training, maintenance and repair procedures, proficiency in specific software tools. Proficiency in tools such as MRO systems and diagnostic equipment, and customer service communication. Desired skills: Conflict resolution, project management, advanced troubleshooting techniques. Professionals shall be able to ensure all authority's safety and airworthiness requirements.

New Training Tools for Engineers: Implemented high-fidelity training tools mirroring aircraft and operational scenarios. Introduced new training tools, such as virtual reality simulations and interactive software. These tools are tailored for engineering tasks and challenges.

Implementation and Training: Conducted engineering training sessions involving instructors and engineers to test course effectiveness and training tools. Identified areas for improvement and made necessary adjustments based on received feedback.

Continuous Monitoring and Evaluation: Established a robust continuous monitoring system, evaluating instructors, engineers, and program effectiveness. Conducted regular audits to ensure program compliance with ANAC regulations and training objectives.

Updates and Improvements: Maintained program flexibility, allowing for regular revisions based on emerging technologies, regulations, and best practices. Gathered feedback from instructors and engineers to identify areas for improvement and enhancement opportunities.

Documentation and Reporting: Maintained detailed records of all activities, training sessions, assessments, and outcomes. Prepared regular reports for ANAC and other stakeholders, highlighting program progress and effectiveness.

Results obtained on Azul's case study

In the Technical Support Engineering Department, specific strategies were employed to identify training needs. The process began with the Research and Initial Planning. Integrating the Technical Support Engineer's Job Analysis and reviewing ANAC/FAA regulations enabled program design. Combining these elements facilitated the development of the program.

The essential step of the case study is the Program Design. It was developed following the guidelines of FAA advisory circular AC 145-10. Additionally, it was identified the crucial training categories for the Technical Support Engineer role. To do this, we considered various training phases, aircraft types, and operational procedures:

a. Initial Training, which encompassed:

- **Indoctrination:** This phase encompasses a comprehensive understanding of FAA/ANAC requirements, Company manuals, policies, procedures, and practices. It includes in-depth knowledge of quality control processes, facility security, and maintenance human factors. Additionally, it covers compliance with Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA). Other pertinent local, state, and federal laws necessitating specialized training were observed.

- **Technical Training:** including Level II Ramp and Transit Aircraft Course, Structural Repair Course - Metallic and/or Composite, Engine Course.
- **Specialized Technical Training:** covering topics such as Reliability, MSG-3, Aircraft Recovery Training, Weight and Balance Training, etc.

b. Recurrent Training. Also known as refresher training. Designed to ensure repair station employees remain capable of properly performing their assigned jobs.

c. Remedial Training, which is provided based on demonstrated need. Remedial training is designed to address immediate knowledge or skill deficiencies. It may focus on individual employees.

Following that, the Course Development phase created training modules. Modules were based on the competencies required for aircraft maintenance engineers. Also, new courses were added to the training. It will address gaps identified during the Program Design and Research and Initial Planning phases. The training matrix presented on the Annex 01 illustrates the new training framework. This new training was developed in the Engineering department to align with the AQP methodology.

It's crucial to note that a substantial effort has been invested in the discussed case. We seek to incorporate new tools like virtual reality, augmented reality, and mixed reality technologies. These tools have useful use within the field of engineering. These innovative approaches are complemented by the use of simulation software and computer-based training programs. This enhances the overall learning experience, following the tendencies of the market as said before.

During the AQP methodology, in the Implementation and Training phase, several outcomes can be highlighted. It is indicators of success and effectiveness:

- **Improvement in Technical Skills**: Demonstrated through an increase in engineers' technical proficiency, measured by practical assessments conducted post-training.
- **Knowledge Retention Rate:** Assessed by comparing participants' knowledge levels before and after training. It helps to determine the extent of learning and retention.
- **Positive Participant Feedback:** Feedback from engineers and instructors involved in the training is collected and analyzed. It helps to understand the program's effectiveness, identifying strengths and areas for improvement.
- **Enhancement in Operational Efficiency:** A KPI is being developed to assess improvements in engineers' operational efficiency post-training. This will evaluate the time required to complete specific tasks.
- **Reduction in Errors and Rejections:** A specific KPI is being created to measure the reduction in error rates or rejections. It will measure technical failures after the implementation of the training.
- **Participation and Engagement:** Participation rates and level of engagement of engineers during training sessions are assessed.
- **Efficiency in Training Processes:** A structured assessment form was developed to evaluate the efficiency of training processes. This includes logistics, resource availability, and time management during training sessions.
- **Monitoring employees' Individual Development Plans (IDPs):** It gives insights whether the training program is being an effective tool for professional growth. It includes leadership skills and problem-solving abilities.

By collecting data and feedback in these areas, tangible and intangible outcomes can be analyzed. During the Implementation and Training phase of the AQP process outcomes can be

effectively demonstrated. The continuous monitoring and evaluation of these outcomes enable an important assessment. An overall program's effectiveness assessment can be analyzed from the instructor's and engineer's feedback. Regular audits are conducted to ensure program compliance with ANAC regulations and training objectives. Improvements are implemented through regular reviews based on training feedback, indicators, and best practices. Input from both instructors and engineers helps identify areas for improvement.

The last step of the AQP methodology is Documentation and Reporting. The engineering department maintains detailed records of all activities, training sessions, assessments, and outcomes. Regular reports track progress and effectiveness.

LATAM Employees Survey

Following our methodology's second and third steps, we conducted a survey with experts. The objective was to gauge employee adherence and perception of training at LATAM Airlines. In 1990, American Airlines pioneered AQP in their training initiatives. By 2015, the United States had 32 AQP programs and 24 approved operators. These programs covered 90% of pilots and about 70% of flight attendants. This period, Delta, United, American Airlines, Southwest, UPS, FedEx, and Jet Blue implemented AQP.

In South America, LATAM is the sole airline using the AQP. The program was initiated in Chile in 2009. In 2019, LATAM expanded AQP to its Brazilian B767 fleet, focusing on Cargo operations. Program was extended to Airbus 320 models (A319, A320, and A321) same year in Brazil. According to LATAM, the AQP enhances curriculum and quality assurance. It employs data-driven methods and adaptability to focus on critical aircrew training tasks. AQP's methodology directly supports safety enhancement objectives in operational areas. Its core goal is achieving excellence in individual and crew performance. The AQP aims to reduce errors from

crew-related factors. So, it aligns training and evaluation criteria closely with established human error sources. It maintains direct connections with Safety Management System (SMS) processes.

Participants

For this study, data were gathered in October 2023 via a contingent valuation assessment. Participants included LATAM Airlines crew members, South America's leading air carrier. They were asked about their perceptions regarding the implementation of the Airline AQP methodology. A total of 32 employees undergoing certification renewal were interviewed.

Among the participants, 69.2% currently serve as first officers, while 30.8% hold pilot positions. Regarding their familiarity with AQP methodology, 46.2% had over 4 years of AQP training experience. 23.1% had between 3-4 years experience, and 23.1% had between 1 and 2 years. A minority of 7.7% had less than 1 year of AQP training experience.

Survey

Conducted by the research team and LATAM's training coordinator, the survey aimed to ensure content validity. It was divided into two sections to collect quantitative and qualitative feedback. The survey involved a concise questionnaire administered through Google Forms containing straightforward questions. This in-depth interview was designed to reveal participants' perspectives and their impact on crew performance. The questionnaire explored four facets of participants' experience with the Airline Qualification Program (AQP) methodology. This included subjective aspects to understand perceptions of the AQP method and its execution. These subjective inquiries focused on two primary themes:

1. An assessment of the AQP implementation by LATAM Airlines.
2. An evaluation of the AQP methodology as a training program.

The remaining questionnaire segment comprised objective inquiries grounded in empirical data, encompassing the following themes:

3. Training performance subsequent to the implementation of the AQP methodology.

4. Flight performance following the implementation of the AQP methodology.

The second section incorporated interpersonal interactions to facilitate communication among research participants for data generation. Interviews were conducted swiftly and efficiently gathering substantial qualitative data from relatively small sample size. Ensuring alignment between thematic focus and participants' input was crucial. Unlike traditional sequential questioning, participants were encouraged to openly express perceptions and opinions. This approach proved invaluable for exploring individuals' awareness and lived experiences. It allowed thoughts examination and the cognitive processes and rationales shaping their viewpoints.

Results Section 1 – Questionnaire

An assessment of the AQP implementation by LATAM Airlines.

69.2% of respondents deemed LATAM’s AQP methodology "excellent," and 30.8% rated it as "good". Notably, no respondents considered the implementation "bad" or "horrible." This suggests that LATAM Airlines successfully followed the AQP's five-phase process. This process ensures a comprehensive understanding and adherence to program obligations and responsibilities.

These phases, as elucidated by Seltzer (2005), are articulated as follows:

1. Application

2. Curriculum development

3. Qualification of instructors and examiners

4. Determination of a Small Group Try Out

5. Continued Operation.

An evaluation of the AQP methodology as a training program.

Among participants, 66.7% classified the AQP methodology as "excellent," and 33.3% rated it as "good." No respondents considered it "bad" or "horrible." They emphasized the AQP's suitability for customizing qualification and training for crew members and dispatchers. Respondents highlighted the method's strength in adapting training through realistic scenarios. The AQP offered tailored training protocols for various aircraft fleets. It allows addressing specific operational needs and enhancing performance, as discussed later.

Training performance after the implementation of the AQP methodology.

Among the survey respondents, 76.9% reported an improvement in their training test performance. 23.1% indicated no change in performance following the implementation of the Airline Qualification Program (AQP). 76.9% respondents noted improved training test performance after AQP implementation, while 23.1% reported no change. AQP methodology requests airlines to establish detailed grading criteria. They shall provide nuanced evaluations by instructors and examiners, moving beyond a binary pass/fail system. The grading scale consists of five grades:

1. Unsatisfactory - Involves deviations from Qualification Standards, uncorrected errors, threats, subpar skills, and compromised flight safety.

2. Standard - Signifies adherence to Qualification Standards. With minor issues promptly addressed and strong individual and team performance with effective skills.

3. Above Standard - Denotes an exceeding of Qualification Standards. With the prompt handling of minor issues and an improvement in safety without operational disruptions.

4. Excellent - Represents consistent adherence to Qualification Standards with exemplary skills.

Prior to AQP implementation, LATAM used a binary grading system. It used to hinder an accurate performance measurement compared to AQP's recommended graded scale. However, post-implementation, there was an 8% increase in test failure rates. It indicated a more precise performance assessment.

Flight performance following the implementation of the AQP methodology.

In the survey, 81.2% of participants noted improved flight performance after LATAM's AQP implementation. Just 18.8% reporting no change. Remarkably, no participants reported a decline in performance post-AQP. This disparity in perceived improvement in flight versus test performance can be inferred. The AQP methodology's stringent evaluation process allows only consistently high performers to renew their certification. Previously, individuals with standard performance could try again and renew certification. This exclusion of standard-performance individuals resulted in fewer certified individuals truly exceptional in their performance.

Results Section 2 – Interviews

Benefits: Most survey participants provided favorable feedback on the Airline Qualification Program (AQP) methodology implementation. They emphasized several key benefits, including:

- **Elevated Performance Standards:** AQP strives to attain and sustain high levels of performance. It helps on bolstering safe operations through a process of continual enhancement and assessment.
- **Flexible Training:** The AQP methodology offers adaptability, permitting customization of training programs with the integration of more realistic scenarios. Different training modules can be tailored to specific aircraft fleets to cater distinct operational needs.

- **Error Mitigation through Realistic Training:** The AQP reduces crew errors by simulating real flight scenarios tailored to each operator's context. It emphasizes innovation and flexibility which mirrors the dynamic airline industry. This is adherent to the principle "Fly as you train and train as you fly".
- **Regulatory Flexibility:** AQP permits regulatory adjustments, allowing modifications in instructional curriculum, operational communication methods, and training intervals. The program also allows the substitution of scheduled training hours with proficiency-based training.
- **Proficiency Enhancement**: Program's primary objective is enhancing pilot proficiency through ongoing individual and team training and evaluation. Advancement to subsequent stages is contingent upon pilots meeting prescribed standards and competencies. Proficiency evaluation encompasses both technical maneuvers and Crew Resource Management (CRM) skills.
- **Qualified Instructors / Examiners:** AQP employs a diverse group of Instructors/Examiners (I/E) to ensure program effectiveness. These I/E individuals undergo training and evaluation to assess crew and peer performance. They play a crucial role in AQP, holding specific qualifications and participating in ongoing education. Training covers instructional techniques, facilitation skills, and examination procedures in actual flight and simulator settings. These individuals are proficient in various roles: Pilot Flying (PF), Pilot Monitoring (PM), instructor, and examiner. Various scenarios simulating startling events during training and examinations are engaged.

Challenges: There´s a widespread consensus of numerous benefits brought to LATAM by the AQP methodology implementation. But also, two significant challenges have emerged that

needs to be considered. The first challenge relates to the AQP's implementation and its potential expansion to other departments. Concerns have been raised by stakeholders about the prolonged implementation timeline. It is driven by the extensive documentation needed. Also AQP requires the creation and maintenance of a comprehensive database. Additionally, the introduction of a new training methodology necessitates a behavioral shift. This involves a paradigm transition for crews, instructors, accredited examiners, and civil aviation inspectors. They will need to adopt and reinforce the different and innovative program methodology. The initiation of operations in phase 4 can take approximately twenty-four to thirty months. This is considering contingent upon uninterrupted documentation development and the availability of resources for instructor and examiner qualification processes.

The second concern revolves around a critical reflection on the AQP methodology itself. Some perspectives suggest an AQP concern. While AQP allows scenarios' customization to meet the airline's reality, it might impose constraints. This selection requests focus on specific technical skills, knowledge, and behaviors, as determined by the operator. This focus could limit adaptability in the face of unforeseen events. One respondent astutely pointed out, "The aviation industry has taught me the importance of being prepared for unforeseen events at all times". 'Black Swan' events are a routine part of our operations. Overreliance on predefined scenarios may lead to biased behaviors and diminished unexpected management capacity.

Conclusions and Recommendations

This project development was based on a deep exploration of the AQP training method. Opportunities were presented in comparison to the methods established in the current Brazilian regulations. Moreover, beyond the crew-focused training implementation, the proposed goal

aimed to explore training effectiveness indicators. These could benefit professionals indirectly tied to operations.

The literature review revealed that the aviation industry's safety relies on continuous professional development. Professional technical and personal skills development is the path to achieving a better safety level.

A case study on Azul Airlines' Technical Support Engineering Department successfully addressed training requirements. It aligned with AQP standards through a well-designed methodology.

Moreover, standardized training procedures, combined with practical simulations, improved technicians' problem-solving and decision-making skills. The program's adaptability addressed department-specific challenges, enhancing efficiency and safety. Integration of advanced simulations and innovative training tools enhanced learning, ensuring standardization and effectiveness.

Integrating studies from Azul and data from LATAM's AQP training since 2019 highlights AQP's versatility. It emphasized the importance of ongoing enhancement and customized training in maintaining aviation safety and quality standards across the sector. This collaboration extends the benefits of AQP to aviation professionals beyond pilots.

The analysis recommends using the training matrix from Appendix 1 as an initial training guideline. It was adopted in the Azul case study and serves as an initial implementation guideline. However, this matrix does not constitute definitive content. It rather provides guidance for developing content extension for professionals indirectly related to the operation.

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