

Structure of Aviation Training in Defence Schools

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ABSTRACT: *We in this paper have studied the air aviation training programs and it has three components. These are Selective, Basic and Advanced. The duration of these programs are four years where the training candidates learn how to fly, and take classes of different subjects to get their major in Aeronautical Science. The Flight Training division has counts with 12 Diamond DA20-C1 aircrafts and 14 instructors, who have the responsibility of preparing future Military Pilots. It was applied a bibliographical research, the information was collected from the Flight Training Manuals, the Aircraft Manual, and Flight Instructors' portfolios which contain all the data related to the last three courses that took place for six months period. A discussion about the relevance of this program in the formation of Military Pilots is detailed, and the findings of this research revealed the number of cadets and other features.*

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1. Introduction

The Ecuadorian Air Force (EAF) invites young adults from 18 to 22 years old to its recruitment process every year. Aspirants undergo through a rigorous selection process, which includes medical and academic evaluations. Those who are accepted must spend four years at the Military Aviation School ESMA, that is located in Salinas, Ecuador. [1] Before arriving at the school, the cadets are classified as pilot-cadets or technician-cadets, and even though, the military training is the same for both specializations, regular or military subjects depend on their major. It is important to mention that, cadets are not only trained to become Military Officers, but they also take classes in order to get their Bachelor "s degree in Aeronautical Sciences. Technician-cadets focus their education on areas related to maintenance, administration, logistics and personnel, on the other hand, pilot-cadets study subjects directly attached to the three flight courses that they must pass to graduate as



Figure 1. Pilot and Technician Cadets of the Military Aviation School ESMA in Salinas

Military Pilots. Cadets who are part of the Military Aviation School in Salinas in their classrooms are in Figure 1.

The objective of this research is to describe the characteristics of the three courses that are part of the flight training program at ESMA, in addition to their importance as part of the preparation of future military pilots. It was applied a bibliographical research, all the information was collected from the materials which were used throughout the last three courses, these are flight training syllabus elaborated by the Flight Training Department at ESMA, the DA20-C1 aircraft manuals, and flight instructors' portfolios. The findings of this study provided a detailed explanation of all the topics covered as well as the number of cadets who passed and the reasons why some failed during the last courses.

2. Pilot Training at the Military Aviation School ESMA in Salinas

The pilot training program at the Military Aviation School ESMA is made up of three courses divided into various phases which are aimed at developing the necessary skills a military pilot should possess to perform tactical maneuvers in different conditions. The first course takes place in the first year and it is called "Selective Course", its main purpose is to determine if the cadets have the aptitude and attitude to face the challenges demanded on military pilots [2].

Once the cadets pass the initial course, they must study and approve all the subjects established as requirements for the next flight course throughout the second year. The "Basic Course" is developed during the third year, and its objective is to provide the future pilots with techniques and strategies to fly the DA20-C1 aircraft using basic and advanced instruments. The last part of the training program is the "Advanced Course", it takes place in the fourth year and it includes different types of navigation, the use of advanced instruments, as well as night flight operations [2].

2.1 Selective Course

It is developed in the first year, and before it starts, subjects such as aerodynamics, aeronautical phraseology, local flight policies, and meteorology are previously taught; these are essential for the cadet's performance before and after flight instruction. This course is mainly based on contact operations, in which, the direction and attitude are provided by visual references, on the other hand, the speed and the altitude are determined by basic instruments like speedometer and altimeter, illustrated in Figure 2 [5].

There are 14 flight missions during this course, and flight instructors are responsible to teach procedures and techniques to clarify any doubts that cadets may have. Additionally, instructors must also ask questions to check if cadets have efficiently prepared flight maneuvers assigned for each mission. This course has only one phase called "Contact" which determines if pilot-cadets have the attitude to face stressful situations and if they do not have any especial physiological conditions such as: getting blocked or dizziness that may prevent them from flying [5].

Previous to all flight missions, there is a meeting between the instructor and the pilot-cadet called "briefing", and its purpose is to discuss all the maneuvers planned by the learner that will be performed throughout the flight. Furthermore, this is when the instructor checks if the cadets have prepared and studied for the mission, hence they must be able to show all the

theoretical knowledge needed on the ground as well as on air. Since all aspects are evaluated when flying, adequate preparation is one of the most important factors to approve each stage of the course, as it is presented in Figure 3 [5].

It is important to mention that one of the maneuvers which is taught at ESMA, is called “Spin”. Its purpose is to teach pilot-cadets how to recover the aircraft ‘s control in emergencies and come back to normal flight conditions, Figure 4 illustrates this flight maneuver.

As future combat pilots, cadets must be aware that in the case of a war, they are likely to take the aircraft to its maximum aerodynamic limitations, and as a result, this may lead them to lose the aircraft “s control because of a spin, therefore, they



Figure 2. DA20 — C1 Basic Instruments



Figure 3. Briefing

must know how to deal with that situation [5].

Flight missions last approximately one hour, and they are graded through the application of “NPDs” (Desired Proficiency Level), which is used to assess 3 main areas: the cadet ‘s skill to perform maneuvers, the ability to plan a lesson, and the necessary knowledge to complete a mission. There are three types of NPDs: (1) which means that the instructor was fully in

charge of the mission and the cadet only observed, (2) which explains that the instructor observed and corrected some aspects of the mission, and (3) which means the cadets were able to perform all the maneuvers without the instructor “s help. Each mission has a score and it is represented by colors, the blue sheet indicates that the cadet has surpassed the required NPDs, the green sheet states that the cadet reached the required NPDS, while the yellow sheet is used for the cadets who did not reach the required NPDs [5].

The level of difficulty increases in each mission and various maneuvers are added throughout the course, for this reason, cadets must demonstrate their knowledge by planning each mission carefully. There is a final test called “Flight Evaluation” on mission 13th in order to determine if the cadets have reached the necessary NPDs. In case the cadets have not gotten the necessary NPDs at the end of a phase, a second opportunity is given. However, according to ESMA policies, a pilot-cadet who fails this second chance is discharged from the school [5].



Figure 4. The “Spin” Maneuver



Figure 5. A “Solo Flight” ceremony

Mission 14th consists of a solo flight, the maneuvers that included are: take off, touch and go and landing. A symbolic ceremony takes place every time a cadet finishes the “Solo Flight”, a crown made of leaves is given in addition to a flight scarf and a cap color green which means the approval of the “Selective Course” as it is illustrated in Figure 5.

2.2. Basic Course

The “Basic Course” starts in the third year and it includes the use of basic and advanced flight instruments along with low-level navigation, for this reason, cadets receive 384 hours of theoretical preparation throughout the second year. Subjects

like: Aeronautical Phraseology, Flight Instrument Procedures, Meteorology, Navigation, among others, are not only considered as part of the curriculum but they are also requirements to access the Basic Flight Course. Military flight instructors are responsible of teaching all these subjects due to the objective of this course is to train pilot-cadets who are able to fly in Visual Meteorological Conditions (VMC) and Instrumental Meteorological Conditions (IMC), as it is displayed in Figure 6 [4].

During this course, the pilot-cadet is introduced to maneuvers that are applied for military missions. There are 45 flight missions which are divided in three phases: Contact, Instruments and Low-Level Navigation. Similarly, NPDs are also applied to assess the cadet's performance while flying. For the approval of this course, pilot-cadets must pass all the phases and get the necessary NPDs [4]:



Figure 6. Low Level Navigation

- **Contact Phase**

The contents of this phase are the same detailed in the Selective Course, because it is necessary that cadets recall the abilities which were acquired in this course [5].

- **Instrument Flight Phase**

It is essential to teach pilot-cadets how to operate in IMC by using flight instruments available on the DA20-C1 aircraft. For this reason, learners must know how to apply flight instrument formulas to interpret instrument approach procedures charts [4].

- **Low-level navigation**

The last phase of the Basic Flight course enables pilot-cadets to develop more tactical maneuvers which will be applied in the field of combat aviation. Learners must plan their missions on the ground through the orographic analysis of a tactical map and by doing all the calculations to obtain the estimated time, fuel and route. All these data are collected in order to be discussed with the instructor before flying [4].

Similar to the previous course, a symbolic ceremony takes place every time a cadet finishes the course, a crown made of leaves is given in addition to a flight scarf and a cap color blue which means the approval of the “Basic Course” as it is illustrated in Figure 7.

2.3. Advanced Course

The “Advanced Flight Course” is developed in the fourth year and it has 35 missions divided into five phases: Contact, Instruments, Low-level navigation, instrumental navigation and night flight. Theoretical preparation continues and the objective of this course is to form pilot-cadets who can perform flight operations in more complex environments as well as to approach and land at different category airports (national and international traffic) [3].



Figure 7. Basic Course Approval Ceremony

- **Contact, Instruments and Low-Level Navigation**

Since the cadets start this course one year after finishing the previous course, the contents of the three phases (Contact, Instruments and Low-Level Navigation) cover the same topics and flight procedures previously detailed in this research. In this way, pilot-cadets are able to recall the abilities which were already acquired [3].

- **Instrumental Navigation**

During this phase, pilot-cadets are prepared to fly an aircraft from one airport to another following a flight level and a determined route. Learners are able to use instrument formulas to interpret instrument approach procedures charts as well as to interact in a more advanced aeronautical environment. This means that pilot-cadets have improved their situational awareness in addition to the ability to communicate with the Air Traffic Controllers [3].

- **Night Flight**

The main goal of this phase is that pilot-cadets develop the ability to perform safely missions under night conditions. Learners are taught how to execute instrumental descents by applying night visual approaches, along with Black Out landings [3].



Figure 8. Advanced Course

Black out landing is an approaching and landing maneuver without aircraft landing lights, its purpose is to simulate an electrical failure or the approximation and landing in high-risk areas in which stealth and surprise must be kept [3].

Once the cadets approve the last course of the pilot training program, a flight scarf and a cap color orange are given during a ceremony, this is illustrated in Figure 8.

3. Results and Discussion

The Pilot Training Program at ESMA has been designed based on all the abilities and skills that future Military Pilots should possess in order to face the challenges presented to each of the types of aviation that the Ecuadorian Air Force has [1].

The first course of this program has the purpose to determine if the cadet is physiologically able to become a pilot, it takes place in the year and that is why basic maneuvers are taught to check if the candidate has the abilities to fly safely [5]. Those who pass are authorized to perform their solo flight, which is the last stage of the phase. According to the documentation found in the Flight Training Department of ESMA [6], thirteen out of thirty-seven cadets were discharged from the school in the last course, the main cause was the lack of skills to perform some maneuvers, consequently, they could not obtain the necessary NPDs, this information is presented in Table 1.

Selective Course			
Number of Cadets	Approved	Failed	Reason
37	24	13	Lack of Abilities

Table 1. Number of cadets who approved the last Selective Course at ESMA

Once the cadets have shown their abilities as pilots, throughout the second course, they acquire knowledge and develop the necessary skills to perform flight operations under pressure. This means that the Basic Course, trains cadets to perform maneuvers which are mainly applied in the military field. The learners from the last course were able to use formulas to interpret instrument approach procedures charts, in addition to, plan and execute a mission by reaching all geographical coordinates traced on a map within the time they previously specified.

However, three out of fourteen cadets did not reach the required NPDs [6], therefore, they were discharged from the school, the information is presented in Table 2.

In the final stage of this program, future military pilots can operate in different scenarios, which means more complex environments. Learners are able to approach and land at different category airports (national and international traffic)

Basic Course			
Number of Cadets	Approved	Failed	Reason
14	11	3	Lack of Abilities

Table 2. Number of cadets who approved the last Basic Course at ESMA

located in the coastal region [4]. Cadets have improved their situational awareness in addition to the ability to communicate with the Air Traffic Controllers not only during the day but also while performing night flights.

Based on the information provided by the ESMA Flight Training Department, two cadets out of sixteen did not pass the course. One of them did not get the required NPDs, and the other had to leave the school in the middle of the course because

of other issues (not related to flight performance), the information is displayed in Table 3.

Advanced Course			
Number of Cadets	Approved	Failed	Reason
16	14	2	<ul style="list-style-type: none"> • Lack of Abilities • Other issues

Table 3. Number of cadets who approved the last Advanced Course at ESMA

Once the cadets graduate as Military Pilots, they are assigned to the different Ecuadorian Air Force (EAF) Bases to fly more advanced equipment. The EAF is in charge of distributing Pilot Officers among the various aviation areas, these are Combat, Transport, Combat Search and Rescue and Supersonic Aviation.

4. Conclusions

The main goal at the Military Aviation School ESMA is to form Pilot Officers who are capable to face the challenges demanded in the next stages of their flight training process. According to the mission of the Ecuadorian Air Force, Combat Pilots must be ready to operate in real scenarios which include high-risk areas. For this reason, cadets spend four years at ESMA, taking classes to form as Military Officers and get their Bachelor 's degree in Aeronautical Science.

There are two specializations at ESMA, Pilot and Technician cadets, the former focus their education in areas related to maintenance, administration, logistics and personnel, and the latter, study subjects directly attached to the three flight courses that they must pass in order to graduate as Military Pilots. This program is in charge of the Flight Training Department and it is cataloged as a rigorous, strict and demanding process which it is directed by officers who possess a long trajectory and a wide range of flight experience.

The "Selective Course" takes place in the first year and it is aimed at determining if the cadets have the attitude and aptitude to face the challenges demanded on military pilots [2]. The second course is the "Basic Course" and it starts in the third year, however, cadets must have approved all the subjects established as requirements to have access to the course. During this course, future pilots are provided with techniques and strategies to fly the DA20-C1 aircraft using basic and advanced instruments. The last part of the training program is the "Advanced Course", it is developed in the fourth year and it includes different types of navigation, the use of advanced instruments, as well as night flight operations [2].

Flight missions last approximately one hour, and they are graded through the application of "NPDs" (Desired Proficiency Level). There are three types of NPDs: (1) which means that the instructor was fully in charge of the mission and the cadet only observed, (2) which explains that the instructor observed and corrected some aspects of the mission, and (3) which means the cadets were able to perform all the maneuvers without the instructor 's help, cadets must reach a minimum of NPDs to pass each of the courses.

The results of this research indicate that the Selective course is the part of the program in which the majority of cadets have been discharged from the Military Aviation School. According to the data provided by the Pilot Training Program System, thirteen out of twenty-seven cadets were dismissed from the school in the last course, whereas, three out of fourteen did not pass the Basic Course and one out of sixteen failed the Advanced Course.

It is necessary to remark the importance of preparing future officers in a strict way because their mission is to protect the country under all kinds of circumstances.

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