CASE STUDY

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Study on the influence of the Fighter Squadron Leader Training Course in the total airborne effort of the 3rd GAV Squadrons

Estudio sobre la influencia del Curso de Formación Líder de Escuadrilla de Caza en el esfuerzo aéreo total de los Escuadrones del 3er GAV

Estudo sobre a influência do Curso de Formação Líder de Esquadrilha de Caça no esforço aéreo total dos Esquadrões do 3º GAV

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ABSTRACT

The goal of this study was to assess the consumption of exclusive flight hours for the training of the Fighter Squadron Leader in the airborne effort of the 3rd GAV Air Squadrons, by comparing the courses conducted in the Brazilian Air Force (FAB) and in the North Atlantic Treaty Organization (NATO). This study sought to measure which airborne effort and which missions of the Fighter Squadron Leader Training Course (CFLEC) are not used in the program of operational maintenance of the Air Squadrons (EsqAe), searching in meaningful learning theories and in the stages of motor learning reasons for such exclusive missions. During the research, the legislations governing the CFLEC and those governing the Flight Lead Upgrade (FLUG) were explored in a NATO member country, used as a standard of comparison. As a survey method, a questionnaire was sent to assess the level of proficiency of the 3rd GAV pilots at the beginning of the course, used as a tool to explain why there are more missions to the CFLEC in comparison with the FLUG, as found in the research. The data analysis verified that, on average, 21% of the total airborne effort of the EsqAe in the year 2016 were dedicated exclusively to missions of the CFLEC, in other words, that they do not have similarities in the program necessary to maintain the operational qualification of the equipment. Compared to NATO, all FLUG missions can be used in the program to maintain the Combat Ready qualification, and they do not require any extra air effort for this purpose.

Keywords: Training course. Fighter squadron leader. Air Effort. Motor learning.

RESUMEN

Este estudio tuvo como objetivo evaluar el consumo de horas de vuelo exclusivas al entrenamiento de del líder de Escuadrilla de Caza en el esfuerzo aéreo de los Escuadrones Aéreos del 3er GAV, mediante una comparación de los cursos de la Fuerza Aérea Brasileña (FAB) y la Organización del Tratado del Atlántico Norte (OTAN). En estudio se buscó valorar el esfuerzo aéreo y las misiones del Curso de Formación de Líder de Escuadrilla de Caza (CFLEC) que no se aprovechan en el programa de mantenimiento operativo de los Escuadrones Aéreos (EsqAe), buscando en las teorías de aprendizaje significativo y en las etapas del aprendizaje motora, razones para tales misiones exclusivas. Durante la investigación, han sido exploradas las leyes que rigen el CFLEC y también las regulaciones del Flight Lead Upgrade (FLUG) en un país miembro de la OTAN, utilizado como criterios de comparación. Como método de elevación, se envió un cuestionario para evaluar el nivel de conocimiento de los pilotos del 3er GAV al inicio del curso, que se utilizó como una herramienta de apoyo a la razón por la que hay una mayor cantidad de misiones requeridas al CFLEC respecto al FLUG como encontrado en la investigación. Del análisis de los datos se verificó que, en promedio, el 21% del esfuerzo aéreo total de los EsqAe en el año 2016 fueron dedicados exclusivamente a misiones del CFLEC, o sea, que no poseen similar en el programa necesario para el mantenimiento de la capacitación operacional de los equipamientos. En comparación con la OTAN, todas las misiones del FLUG pueden utilizarse en el programa destinado a mantener la calificación de Combat Ready, en el que no se requiere un esfuerzo aéreo extra para este propósito.

Palabras clave: *Curso de formación. Líder de escuadrilla de caza. Esfuerzo Aéreo. Aprendizaje motor.*

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The acronyms and abbreviations contained in this article correspond to the ones used in the original article in Portuguese.

RESUMO

Esse estudo teve como objetivo avaliar o consumo de horas de voo exclusivas à formação do Líder de Esquadrilha de Caça no esforço aéreo dos Esquadrões Aéreos do 3° GAV, através da comparação entre o curso realizado na FAB e na OTAN. A pesquisa apresenta características exploratórias, pois buscou mensurar qual esforço aéreo e missões do Curso de Formação de Líder de Esquadrilha de Caça (CFLEC) não são aproveitados no programa de manutenção operacional dos EsqAe, buscando nas teorias de aprendizagem significativa e dos estágios da aprendizagem motora razões para tais missões exclusivas. Na realização da pesquisa documental foram exploradas as legislações que regem o CFLEC e também as que regem o Flight Lead Upgrade (FLUG) em um país membro da OTAN, utilizado como critério de comparação. Como método de levantamento, foi enviado um questionário para avaliar qual o nível de proficiência dos pilotos do 3° GAV ao início do curso, utilizado como ferramenta para fundamentar o motivo de existir uma maior quantidade de missões necessárias ao CFLEC em relação ao FLUG, conforme encontrado na pesquisa documental. A análise dos dados revelou que, em média, 21% do esforço aéreo total dos EsqAe no ano de 2016 foram dedicados exclusivamente à missões do CFLEC, ou seja, que não possuem similar no programa necessário à manutenção da capacitação operacional das equipagens. Comparativamente à OTAN, a totalidade de missões do FLUG pode ser utilizada no programa destinado a manter a qualificação de Combat Ready, não demandando esforço aéreo extra para esse fim.

Palavras-chave: *Curso de Formação. Líder de Esquadrilha de Caça. Esforço Aéreo. Aprendizagem motora.*

1 INTRODUCTION

The Fighter Squadron Leader Training Course (CFLEC) is taught by Air Squadrons (EsqAe) of the 3rd Aviation Group (3rd GAV), consisting of 1st/3rd GAV, 2nd/3rd GAV and 3rd/3rd GAV, which operate the A-29 aircraft.

The CFLEC has a duration of two years and begins as soon as the pilot graduated from the Fighter Aviation Operational Specialization Course (CEO-CA) presents himself in one of these three squadrons. During these two years, each student performed 47 missions assessed and consumes a total air effort[1] of 120 hours (BRASIL, 2016a).

With an average of eight and ten new pilots received annually, the amount of resources needed for each student in the CFLEC has required a great effort from the EsqAe, to the detriment of other programs of training and of operational maintenance of other crew, which has been worsening due to frequent decreases in the budget of the Armed Forces.

Unlike this course model, in which a pilot with little or no operational experience starts attending the CFLEC shortly after completing the fighter pilot course, Air Forces from other countries use a different method. According to reports from fighter pilots from Chile, the United States, France[2] and an exchange report with the Ecuadorian Air Force (BRAZIL, 2015), pilots are required to have a minimum experience ranging from 2 to 3 years or about 400 hours on the aircraft, before starting the leadership training programs.

On the other hand, these programs are considerably shorter in terms of course duration and number of missions (on average ten missions assessed), as well as being focused on the operational missions of the Air Squadrons, with little or no basic operational phase.

For this reason, this research proposes to elucidate the following problem: What is the consumption of exclusive flight hours to the training of the Squadron Leader in the air effort of the 3rd GAV EsqAe, comparing the methodology of the Brazilian Air Force (FAB) course with that of the North Atlantic Treaty Organization (NATO)?

To answer the research problem, the following Guiding Questions (GQ) were elaborated:

GQ1: What is the consumption of exclusive flight hours to the training of the Squadron Leader in the air effort of the EsqAe, according to the FAB methodology?

GQ2: What is the consumption of exclusive flight hours to the training of the Squadron Leader in the air effort of the EsqAe, according to the NATO methodology?

Thus, we intend to reach the General Objective (GO) of the research that is to measure the consumption of exclusive flight hours for the training of the Fighter Squadron Leader in the air effort of the 3rd GAV EsqAe, comparing the methodology of the course of the FAB with that of NATO´s. For this purpose, the following Specific Objectives (SO) were also detailed:

SO1: Identify the consumption of exclusive flight hours to the training of the Squadron Leader in the air effort of the EsqAe, according to the FAB methodology.

SO2: Identify the consumption of exclusive flight hours to the training of the Squadron Leader in the air effort of the EsqAe, according to the NATO methodology.

[1] Air Effort. Amount of hours flown by the aircraft.

[2] Information obtained during the exchange of a Chilean Air Force A-29 pilot in the 1st/3rd GAV in 2015, and through reports of French and American pilots in the 2010 and 2013 editions of the CRUZEX exercise.

2 THEORETICAL FRAMEWORK

Since the comparison between the two methods of air leadership instruction (FAB and NATO) enters into the field of learning, the author presents, in this section, the researchers and studies used in the assessment of the researched scenario.

According to Ausubel, Novak and Hanesian´s (1983) Meaningful Learning Theory, the importance of what is learned previously, about what will be assimilated in the future, creates a dependency between these two contents. This theory states that meaningful learning occurs when new information is anchored in preexisting relevant concepts (subsumbtions) in the learner's cognitive structure. Thus, the new knowledge must be added to previous contents, giving continuity to the learning, which can change and (or) give another meaning to the previous ones. As stated by Ausubel, Novak, and Hanesian (1983), new ideas can only be learned and retained in a useful way if they refer to concepts and propositions already available in the subconscious of the learner, and which provide conceptual anchors.

According to this theory, the concepts assimilated for the accomplishment of a mission like Fighter Operational Wing serve as subsumption concepts for the learning of the leadership in these same missions, in situations in which the pilot must make decisions according to the scenario that will be presented, on a mission already mastered by him/her.

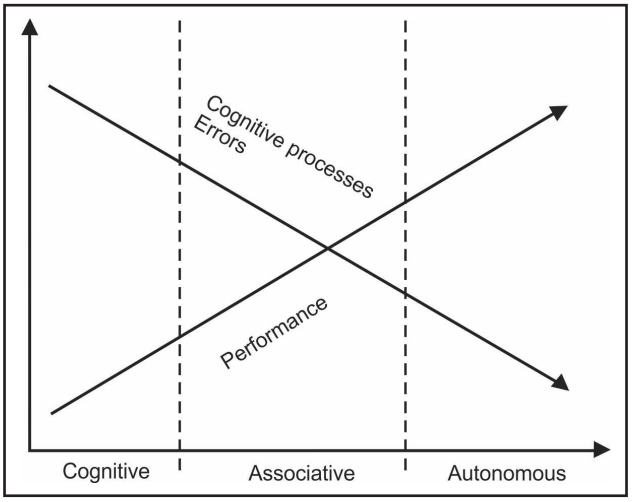
From the point of view that the piloting of an aircraft also involves psychomotor aspects, the theory about motor learning comes to complement the theoretical base used in this work. The model developed by Fitts and Posner (1967) presents three stages of motor learning: cognitive, associative and autonomous.

The first of these is the cognitive stage, in which the skill is presented to the subject. Its characteristics are: the occurrence of a large number of errors and a lot of variability in the performance of the activity. The cognitive activity is very high, causing an overload in the mechanisms of attention. For several times, the person is able to perceive the error, but still does not know how to correct it. The proficiency gains are very high at this stage, and the learner focuses on the problems of cognitive nature, and seeks to visualize and process the relevant information to the recognition of the objectives and aspects necessary for the execution of the task.

After a certain period of practice, the individual goes to the associative stage, in which he is able to perform the activity more easily, reducing the number of errors and the variability in the attempts. The cognitive load for performance is moderate and the efficiency of movement is improved. At this stage the student shifts his/her emphasis from cognitive and strategic problems to a phase of more effective and standardized organization of movements to perform the task, seeking to associate movements with certain environmental responses. This stage is also called the refinement stage, where performance variability begins to decrease, and errors are less coarse. It lasts longer than the first stage, and it lasts up to several months.

Finally, after practicing the activity extensively the individual can reach the autonomous stage. At this stage the subject is able to perform the activities automatically, with little variability and with a small load in the cognitive mechanisms. However, performance improvements are more difficult to be detected because the individuals are close to the limits of their capabilities and there is little variability between subsequent attempts. To achieve this stage years of practice may be necessary, and many individuals, even with lots of practice, may not achieve that level. It all depends on the task to be learned.

Figure 1 – Motor Learning Stages.



Source: Fitts e Posner (1967).

From the point of view of the Fitts and Posner model (1967), initiating an operational progression to Squadron Leader in pilots still in a low stage of motor learning regarding the flight in Fighter Aviation will result in a considerable loss of part of the mechanisms of attention, which will be directed to the tasks of piloting the aircraft, whereas in some

situations, the pilot should already have a greater domain that would allow him to focus the cognitive processes on the understanding and analysis of the presented tactical scenario. Therefore, during a leadership flight, the closer the pilot is to the autonomous learning stage, the more cognitive and attention capacity will be available for the activities inherent to the leadership of a squad.

3 METHODOLOGY

This study fits into the context of the Air Force Education, particularly in the CFLEC analysis conducted in the 3rd GAV EsqAe.

Based on the classification presented by Gil (2002), this study, based on its objectives, is exploratory, once it was proposed to measure which air effort and which CFLEC missions are not used in the the Air Units (UAe) operational maintenance program, and it searches in the theories of meaningful learning and in the stages of motor learning reasons for such exclusive missions. As for the technical procedures used, according to Gil (2002), this work was classified as documental research and survey.

In order to meet SO1, documentary research was conducted on the legislation that governs the CFLEC and the operational training of fighter pilots, including ICA 11-59 - Operational Instruction and Maintenance Program (PIMO) of the 1st/3rd GAV (BRAZIL, 2016a), the IOC PRO-11C - Crews Training (BRAZIL, 2016d) and the IOC REL-06B - Operational Assessment of Air Units (BRAZIL, 2016e).

The data derived from the flight hours obtained from SO1 would have a little meaning in an isolated context. For this purpose, SO2 appears to establish a reference parameter, in order to obtain a comparison between the exclusive air effort consumption of the CFLEC and a reference sample. For this sample the Flight Lead Upgrade Course (FLUG) was selected, as it is a similar course to the CFLEC carried out within NATO. As legislation, MCA 503-2 - Pilot Qualification in F-16M (PORTUGAL, 2011), of the Portuguese Air Force, member country of this treaty, was used.

The assessment criteria used to measure the exclusive air effort consumption for each leadership course (CFLEC and FLUG) was to compare the missions of each course with the minimum required for operational maintenance as a fighter pilot. The additional missions required for CFLEC were quantitatively compared to those of the FLUG, used as the reference sample.

The assessment of the CFLEC was carried out in the year of 2016, encompassing the air effort data, the number of pilots and the curriculum of the current course of the three EsqAe of the 3rd GAV, in that period. The FLUG includes the current curriculum in 2011, due to the availability of such documentation.

However, the simple comparative analysis between the results of the two specific objectives above only points out the differences between the FLUG and the CFLEC, without merits of adequacy of the FAB´s course. Therefore, a technical survey procedure was carried out, through a questionnaire, to verify if the level of pilot proficiency at the beginning of the CFLEC is adequate to the need of the course.

This questionnaire was sent to the three EsqAe of the 3rd GAV with specific questions to assess the proficiency levels of the pilots at the beginning of the CFLEC, as well as the desirable level of proficiency for the beginning of this course. These proficiency levels were scaled according to the Likert scale, ranging from the cognitive stage to the autonomous stage of motor learning, and they are detailed in item 4.3.

This assessment was made by experts and comprises the analysis of the universe of 52 CFLEC pilots in 2016. Pilots with more than 500 flight hours on the A-29 aircraft or Fighter Aviation, i.e. pilots considered as **experienced**, were defined as experts for such issues. The hours criterion was based on Air Force Instruction 11- 412 - Aircrew Management (AFI-11-412), which sets the 500-hour parameter to consider a fighter pilot as expert. (USA, 2009). There is no document within the scope of FAB which defines the concept of an **expert pilot**. Therefore, the concept used is one of a NATO Air Force.

The universe of expert pilots to which the questionnaire was sent corresponds to a **n** of 48 individuals. With the return obtained from 46 questionnaires, a margin of error of 3% was obtained within a 95% confidence interval, calculated with the help of its own statistical software.

Finally, the data analysis of the two specific objectives allowed to carry out an assessment of the exclusive air effort consumption to the CFLEC compared to the FLUG and to classify it according to this reference value. The aim of the questionnaire was to assess, even with the difference found between the two courses, if the CFLEC is adequate or presents an opportunity to evolve in its criteria and curriculum. On the other hand, the theories of the theoretical framework were used to link the difference of the number of missions to the level of initial proficiency of the pilots, according to the theory of meaningful learning and to the model of motor learning, which, besides justifying the presented conclusions, may guide eventual opportunities to improve the current course.

4 DATA AND ANALYSIS

Initially, the collected data will be presented aiming to reach the two specific objectives of this research. Then, the results of the questionnaire sent to experienced pilots of the 3rd GAV will be presented, which underpinned the analysis of the results of the specific objectives according to the theories of learning already addressed.

4.1 Fighter Squadron Leader Training Course (CFLEC)

The requirement to be declared a Fighter Squadron Leader, at the time this article was written, was defined by the IOC PRO-11C[3] - Crews Training (BRAZIL, 2016d), of the Third Air Force (III FAE), which provides that the pilot, in addition to completing the CFLEC, must have more than 400 flight hours in the Fighter EsqAe.

For the CFLEC specifically, ICA 11-59 - Operational Instruction and Maintenance Program (PIMO) of the 1st/3rd GAV was analyzed (BRAZIL, 2016a). Since this course is standardized under the Preparation Command (COMPREP), the EsqAe source of this document, among the three Squads of the 3rd GAV, does not change the content of the analysis.

According to the PIMO of the 1st/3rd GAV (BRAZIL, 2016a), the specific part of the leadership course has a duration of two years, being divided into two programs. In the first year of the course, the student joins the Operational Elevation Program 1 (PEO 1) and will fly in the No. 3 position in a squadron of four aircrafts. This program comprises fourteen assessed missions. In the second year of the course, the student joins the Operational Elevation Program 2 (PEO 2), and will fly in the Ace (leader) position in formations of two to four aircrafts. The PEO 2 consists of 33 assessed missions, totaling 47 missions throughout the CFLEC.

The PIMO also states that pilots will start PEO 1 as soon as they perform the readjustment missions on the A-29 aircraft. Thus, the new Operational Fighter Wings starts the CFLEC as soon as they present themselves in the EsqAe of the 3rd GAV and are readapted to the flight.

All PEO 1 missions are planned to be carried out to be the same missions already planned for the PEO 2. Thus, for the analysis of the air effort aimed to the CFLEC, only the consumption aimed to the PEO 2 will be measured, and all the other aircrafts will be considered as support, since the flights of the PEO 1 do not impact on the quantity of attacks needed.

Table 1 lists the number of missions per phase of PEO 2, as well as the total air effort of each phase. Then, the expected number of annual missions in the IOC REL-06B - Air Units Operational Assessment (BRAZIL, 2016e) is presented, so that the pilot can reach a minimum expected operational maintenance standard. Finally, a comparison between the CFLEC and IOC REL-06B is made, and it details which air effort must be allocated in each phase more than it is necessary for the operational maintenance of the pilots. This last column reflects the air effort that should be assigned exclusively for the CFLEC, per student, without exploitation in the minimum operational maintenance program as mentioned in IOC REL-06B.

Table 1 – Missions and air effort aimed for CFLEC.

Phase	CFLEC		IOC REL-06B	Additional Effort For CFLEC	
	Missions	Total Hours (Student + Support)	Planned missions	Missions	Hours
Graduation	8	27:20	0	8	27:20
Radio Navigation	2	08:00	0	2	08:00
Air-Ground Stand	4	20:00	3	1	05:00
1x1 Combat	2	04:00	3	0	00:00
2x1 Combat	5	15:00	5	0	00:00
Air Shooting	2	08:00	1	1	04:00
Attack	4	16:00	20	0	00:00
Air Sup. Approx.	2	06:10	2	0	00:00
Escort	2	12:00	1	1	04:00
Air Defense (44F)	2	04:00	6	0	00:00
TOTAL	33	120:30	-	13	48:20

Source: Adapted from Brazil (2016a, c).

[3] Document in process of adaptation to a Preparation Rule (NOPREP) of COMPREP, due to the restructuring of FAB.

Bearing the SO1 in mind, it is noted that approximately 120 flight hours are consumed each year for each PEO 2 pilot, of which 48 hours are not used in the operational maintenance program, and are characterized as CFLEC exclusive missions and demand extra air effort to be spent by EsqAe.

4.2 *Flight Lead Upgrade* (FLUG)

For this course, a research was performed on the MCA 503-2 - Pilots Qualification in F-16M (PORTUGAL, 2011), of the Portuguese Air Force (FAP), a country belonging to NATO. Unlike the way adopted in Brazil, this operational increase is divided into two stages of leadership: Two-Ship Flight Lead Upgrade (FLUG 2) and Four-Ship Flight Lead Upgrade (FLUG 4), which would be equivalent to one course for Element Leader and one for Squadron Leader.

MCA 503-2 does not adopt a criterion for completing the course, but only to begin. According to this document, to begin the FLUG 2, the pilot must be operational in F-16 and have more than 400 flight hours in that aircraft. But to begin the FLUG 4, the pilot must have completed the FLUG 2 and already have an experience of 200 element leadership flights (*Two-Ship Flight Lead*).

Both courses, FLUG 2 and FLUG 4, have only operational missions: Basic and Advanced Combat (BFM and ACM), Tactical Intercept, OCA Sweep, Air Defense (DCA FAOR), Attack on a context of composite air missions (COMAO A/G) and Close Air Support missions.

FLUG 2 consists of ten missions, seven air-air and three air-ground missions. FLUG 4 is composed of six missions, four air-air and two air-ground. It is not possible to determine if the FLUG 2 missions can occur in favor of the existing FLUG 4 outcomes as performed between PEO 1 and PEO2. Thus, the analysis of extra missions and air effort, different from that performed in item 4.1, was done in an individualized way for each course.

As in the CFLEC analysis, Tables 2 and 3 demonstrate the amount of missions and air effort allocated to FLUG 2 and FLUG 4 and the number of annual missions planned in the Continuation Program to maintain Combat Ready[4] qualification, besides the comparison between the FLUG and the Continuation Program, detailing if there is a need to allocate an exclusive air effort to the leaders training.

Table 2 – Missions and air effort aimed for FLUG 2.

Phase	FLUG 2		Cont. Program	Additional Effort for FLUG 2	
	Missions	Total Hours (Student + Support)	Planned missions	Missions	Hours
1x1 BFM	1	02:00	2	0	00:00
2x1 ACM	1	03:45	2	0	00:00
Tactical Intercept	1	04:30	2	0	00:00
OCA Sweep	2	18:00	5	0	00:00
DCA FAOR	2	15:00	6	0	00:00
COMAO A/G	2	18:00	11	0	00:00
Close Air Support	1	03:00	7	0	00:00
TOTAL	10	64:15	-	0	00:00

Source: Adapted from Portugal (2011).

Table 3 – Missions and air effort aimed for FLUG 4.

Phase	FLUG 4		Cont. Program	Additional Effort for FLUG 4	
	Missions	Total Hours (Student + Support)	Planned missions	Missions	Hours
COMAO A/G	2	24:00	11	0	00:00
OCA Sweep	2	24:00	5	0	00:00
DCA FAOR	2	27:00	6	0	00:00
TOTAL	6	75:00	-	0	00:00

Source: Adapted from Portugal (2011).

[4] *Combat Ready*. Qualification in which the pilot is able to participate in real operational missions, without the need for additional training at headquarters before being assigned to the mission.

For the graduation of a pilot as a Squadron Leader (Four-ship Lead) in this standard used by NATO, it takes about 140 total flight hours for each student's program. Although there are few planned missions (sixteen in total), the allocated air effort becomes high because the scenario of each mission is more complex with up to ten aircraft involved.

Regarding the SO2, the data show that, even with this high air effort, all missions, both student and support flights, can be fully exploited in the pilots' operational maintenance program, according to the missions already planned to be carried out in the Continuation Program, not requiring, in practice, any extra air effort for this course.

4.3 Proficiency of the pilot to start the CFLEC

In order to provide more support to the analysis based on the theoretical framework, in view of the evident difference in the flight experience of the students at the beginning of the CFLEC, in comparison with the FLUG, a questionnaire was sent to assess the proficiency level of the 3rd GAV EsqAe pilots.

According to the theoretical interpretation that a pilot still in an early stage of learning will require more time to reach a proficiency that allows him/her to dedicate enough attention mechanisms to understand and analyze the tactical scenario, the results of this questionnaire provided practical data that corroborate this theory, through the analysis of the pilots' proficiency level at the beginning of the CFLEC in comparison with the desirable level, which provides more reliability to the theoretical analysis.

This questionnaire had the perception of expert A-29 pilots (more than 500 hours), as discussed in item 3, about the proficiency level of the pilots in two different situations: when they arrived in the UAe to start the CFLEC, and on what the real desired level would be.

At another time, the respondents were asked about the flight experience a pilot should have to achieve the desired level of proficiency.

For the questions, a tactical scenario to accomplish an Attack action was considered, as normally found in an Operational Exercise (BRAZIL, 2016c). The proficiency to be assessed was divided into five different levels, defined by the author:

a) Level 1: insufficient situational awareness to react to in-flight threats. Use of incorrect weaponry or with foul[5] that affect mission performance (TVB[6], recovery foul, etc.);

b) Level 2: reduced situational awareness, but the pilot reacts correctly when receiving a Threat Call[7]. Use of weaponry within established limits, or with a foul that does not affect the performance of the mission (speed, axis, etc.);

c) Level 3: satisfactory situational awareness. The pilot can see the scenario through Pictures[8] and use the Threat Call to define the defenses. Exploit the weaponry within established limits, without any foul;

d) Level 4: high situational awareness. Good understanding of the scenario through Pictures, which makes it possible to predict future actions. The Threat Call information serves as an aid, but the pilot does not depend on it to react to threats. Use of weaponry with little variation of the predicted use parameters; and

e) Level 5: full situational awareness. Full understanding of the scenario through the Pictures. The Threat Call information has little influence on the understanding of the scenario. Use of weaponry with little or no variation of the predicted use parameters.

Table 4 represents the answers given by the expert pilots about the level of a pilot newly arrived at the EsqAe, who will consequently start the CFLEC, as well as the desirable proficiency level to start the course.

Table 4 – Perception of expert pilots on the proficiency of FAB Fighter pilots at the beginning and the desirable proficiency for the CFLEC.

Proficiency Level	At the beginning of CFLEC	Desirable for CFLEC
Level 1	61%	0%
Level 2	35%	26%
Level 3	4%	50%
Level 4	0%	22%
Level 5	0%	2%

Source: The author.

[5] *Foul*. Failure to comply with the limits of the predicted use parameters when launching the weaponry.

[6] Bomb Flight Time. There is a minimum BFT, usually 4.8 seconds, to allow the bomb fuse to be armed only at a safe distance from the aircraft.

[7] *Threat Call*. Radio message transmitted to the pilot to report the presence of an airborne threat below established minimum distances. Usually demands an evasive maneuver.

[8] *Picture*. Radio message that transmits, in broadcast format, to all the pilots, the positions of the enemy aircraft, in relation to a known point (Bullseye).

It is important to note that an expressive amount of expert pilots (61%) consider that the proficiency level of fighter pilots at the beginning of the CFLEC is still low (level 1). In addition, 74% of expert pilots believe that the CFLEC students must achieve at least level 3 or higher before the beginning of the course.

Table 5 represents the perception of what flight experience a pilot should have to achieve the level of experience desirable to start the CFLEC.

Considering that a pilot enrolls in the 3rd GAV EsqAe with about 100 flight hours on the A-29 aircraft (BRAZIL, 2016b), and performs an average of 150 flight hours per year in these UAe, none of the pilots questioned considers that the flight experience at the end of the CEO-CA is enough to start the CFLEC. A total of 70% of these pilots consider that the student must be at least in the second year of locality, which reflects, on average, more than 250 hours in the aircraft.

4.4 Data analysis

From the comparison of items 4.1 and 4.2, it could be seen that the FLUG demands a total amount of hours higher than the CFLEC for the qualification of the pilot as a Squadron Leader. However, this higher air effort arises from the greater complexity of the missions, and not from their quantity. While in FLUG 2 and 4 there are sixteen assessed missions in total, with up to ten aircraft involved in a single mission, the CFLEC curriculum comprises a total of 47 missions, with a much longer duration and less complexity in each instruction.

Regarding the consumption of exclusive air effort, for each PEO 2 of the CFLEC, it takes about 48 hours for missions that do not have use in operational maintenance, which can represent up to 480 hours per year per EsqAe. Taking as an example the annual air effort of the 3rd GAV Squadrons for the year of 2016, which varies between 1981 and 2120 hours, and that, in the mentioned year, each Air Squadron has nine pilots in the PEO 2, only this consumption of extra hours represents a total of 435 hours, which corresponds to an average of 21% of the total air effort of each squadron. In the FLUG, even involving a greater amount of air effort, the totality of missions can be used to maintain the pilots' operability, which corresponds to a possibility of 0% allocation of exclusive flight hours to this training.

The motor learning model of Fitts and Posner (1967) confirms the reason for CFLEC to demand a greater number of missions for the same purpose of the FLUG. Even with analysis related only to FLUG 2, in which the flight experience at the end of both programs is very similar (about 400 hours), the fact that the CFLEC starts with a pilot who has recently completed the fighter course implies that the curriculum has more missions to achieve the same end product. As a result, there is little quantitative difference in experience between the CFLEC and FLUG 2 at the end of the course, but there is a considerable difference in the path used for this end.

The result of the questionnaire sent to 3rd GAV expert pilots showed that pilots start the CFLEC at a level below that required for the course. This justifies the need for more assessed missions, as well as the existence of more basic missions that are not planned in the REL-06B IOC and that are not used for the operational maintenance of the pilots.

Once again, establishing a parallel between the results of the questionnaire (level 1 of proficiency when arriving in the UAe) with the learning theory of Ausubel, Novak and Hanesian (1983) and the motor learning model of Fitts and Posner (1967), it is noticed that the CFLEC pilots, besides devoting themselves to the learning of flight as a leader, they are still in the process of evolving learning in their own activity as fighter pilots. This statement implies that the subsumption concepts required for leadership flight learning are not yet adequately incorporated into the student's cognitive structure at the beginning of the CFLEC, as well as his/her motor aptitude does not allow to direct a significant portion of his/her attention mechanisms to the cognitive processes required to a leadership flight at the beginning of the course. In essence, for a flight as a Squadron or Element Leader, the pilot needs a correct situational assessment while, at the same time, he/she correctly performs the piloting actions inherent to the mission.

Table 5 – A-29 flight hours required to obtain the desired proficiency to start the CFLEC.

Flight hours in A-29	Perception by expert pilots
100h (at the end of CEO-CA)	0%
100 to 250h (in the 1st year in UAE)	30%
250 to 400h (in the 2nd year in the UAE)	37%
400 to 550h (in the 3rd year in the UAE)	26%
More than 550h (from the 4th year in the UAE)	7%

Source: The author.

5 CONCLUSION

This research, which originated from the author's experience in airborne activities in the 3rd GAV Squadrons, analyzed the consumption of exclusive flight hours to the current Fighter Squadron Leader Training Course.

Noting the growing effort to the CFLEC to the detriment of the other programs of training and operational maintenance, the author arose the concern about the discovery of the real exclusive consumption of air effort demanded by the CFLEC, mainly after learning about other training programs from other Air Forces.

Thus, the following research problem was outlined: What is the consumption of exclusive flight hours to the training of the Fighter Squadron Leader in the air effort of the 3rd GAV EsqAe, comparing the methodology of the FAB course with NATO´s? In order to find the answer to this question, the work of documentary research was initiated in the legislations that govern the leadership course in FAB and in a NATO member country, which in the case of this study was Portugal.

In compliance with the Specific Objective 1, it was found that the CFLEC has a total of 47 missions and consumes, on average, about 120 total flight hours for each PEO 2 student. However, from this total air effort, only 72 hours can be used for the pilots' operational maintenance, in accordance with the minimum requirements mentioned in the IOC REL-06B. Based on the air effort and the number of students of these EsqAe for the year of 2016, the 48 exclusive hours to the CFLEC, per student in the PEO 2, represent an average consumption of 21% (435 hours) of all the annual air effort of these squads.

In the case of FLUG, in compliance with the Specific Objective 2, it was found that the course, divided in two modules (Two-Ship Flight Lead Upgrade and Four-Ship Flight Lead Upgrade), has a total of sixteen assessed missions and consumes a total of 140 flight hours, a greater air effort than assigned to the CFLEC. However, all FLUG missions are directed to operational flights, which implies that the entire air effort consumed can be used for operational maintenance such as Pilot Combat Ready, as provided in the Continuation Program. As a result, FLUG has 0% influence on air effort.

With this data, and the results of the questionnaires sent to the 3rd GAV pilots, it was possible to establish a relationship between the learning theory of Ausubel, Novak and Hanesian (1983) and the motor learning model of Fitts and Posner (1967). Considering that the CFLEC student starts the course with only 100 hours of experience on A-29 (BRAZIL, 2016b) and on Fighter Aviation, in comparison to FLUG, in which the requirement is at least 400 hours in the aircraft, we conclude that the CFLEC student starts the course with a proficiency level, that is, motor and cognitive learning lower than that of the FLUG student. It is also noticed that besides devoting themselves to the learning of flight as a leader, the pilots are still in process of evolving learning as fighter pilots.

This statement implies that the subsumption concepts required for leadership flight learning are not yet adequately incorporated into the student's cognitive structure at the beginning of the CFLEC, as well as his/her motor aptitude does not allow to direct a significant portion of his/her attention to the cognitive processes required to a leadership flight. In its essence, the pilot needs a correct situational assessment at the same time that he/she correctly accomplishes the piloting action inherent to the mission.

This conclusion was corroborated by the results of the questionnaire submitted to the 3rd GAV expert pilots, in which 61% of the answers considered that the student, at the beginning of the CFLEC, was still at proficiency level 1 (insufficient situational awareness to react to in-flight threats and (or) incorrect use of weaponry or foul that affect mission performance - TVB, recovery foul, etc.). In addition, a total of 70% of expert pilots considered that the student should be in the second year of the UAe or more (considering an average of 150 flight hours per year) to start the CFLEC, which denotes that the current requirement for beginning the course is not appropriate for its need.

Thus, regarding the research problem, it is concluded that the CFLEC presents a high exclusive air effort consumption of the course when compared to the FLUG, considering that, on average, 21% of the annual air effort for 2016 of each Squadron will not be used during the operational maintenance of the pilots. Even if the FLUG demands a greater amount of total air effort for the course, there is no additional demand on the air effort, since all its missions can be used in the operational maintenance of the pilots involved.

Finally, the results obtained here open a wide range of fighter aviation research opportunities, which can be developed for improvement of the CFLEC, such as studies about the competences required for a Fighter Squadron Leader and studies about the initial requirement and the required curriculum for the course, in order to maximize the efficiency on the use of the resources allocated to the EsqAe, allocating the largest possible share of the air effort in missions that contribute most significantly to the operational maintenance of the equipment, in accordance with the mission assigned by the COMPREP.

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