The impact of air effort reduction on instructor pilot training between 2012 and 2015

El impacto de la reducción del esfuerzo aéreo en la formación del piloto instructor entre 2012 y 2015

O impacto da redução do esforço aéreo na formação do piloto instrutor entre os anos 2012 e 2015

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ABSTRACT

This study analyzed the operational elevation of instructor pilots focusing on the number of estimated hours in the operational instruction and maintenance program (OIMP). Thus, the objective is to identify the impact of the air effort reduction for the 1st/2nd Transport Group (TG) regarding the amount of hours for the flight instructor pilot training in C-99 aircraft between 2012 and 2015. Descriptive research based on document analysis was used. The air effort information was obtained from the Opera System and the hours flown by the pilots up to the time of the operational flight board, in which the training pilot becomes an instructor, found in the board minutes. Such information were presented through tables, which were analyzed and correlated with Pearson's linear coefficient ($r = -0.15$). Considering the result, it is possible to verify that there is a weak negative relation between the variables, that is, the air effort reduction did not impact the training of the pilot instructor because the pilots reached a minimum of 600 hours established at OIMP. Therefore, based on the Theory of Constraints by Goldratt, in its first stage of identifying the restriction, it is possible to conclude that the air effort reduction was not the constraint in the instructor's training process.

Keywords: Air Effort. Training. Experience. Instructor Pilot. Theory of Constraints.

RESUMEN

Este estudio analizó la elevación operativa de los pilotos instructores con un enfoque en la cantidad de horas previstas en el programa de instrucción y mantenimiento operativo (PIMO). Con esto, el objetivo es identificar el impacto de la reducción del esfuerzo aéreo destinado al 1er/2 do Grupo de Transporte (GT) en el número de horas de formación del piloto instructor de vuelo en aeronaves C-99 entre los años 2012 y 2015. Realizar una investigación descriptiva con base documental. La información de esfuerzo aéreo, obtenida del Sistema Opera, y las horas voladas por los pilotos hasta el momento del tablero de vuelo operativo al instructor, que se encuentran en las actas del tablero, se presentaron a través de tablas, se realizaron los análisis y luego se correlacionaron por Coeficiente lineal de Pearson ($r = -0,15$). Con el resultado, se puede verificar que existe una relación negativa débil entre las variables, es decir, la reducción del esfuerzo aéreo no afectó la formación del piloto instructor, ya que los pilotos alcanzaron el mínimo de 600 horas establecido por PIMO. Por lo tanto, con base en la Teoría de las restricciones de Goldratt, en su primera etapa de identificación de la restricción, se puede concluir que la reducción del esfuerzo aéreo no fue el cuello de botella en el proceso de formación del instructor.

Palabras clave: *Esfuerzo aéreo. Capacitación. Experiencia. Piloto Instructor. Teoría de las Restricciones.*

RESUMO

O presente estudo analisou a elevação operacional dos pilotos instrutores com foco na quantidade de horas previstas no programa de instrução e manutenção operacional (PIMO). Com isso, o objetivo

é identificar o impacto da redução do esforço aéreo destinado ao 1º/2º Grupo de Transporte (GT) na quantidade de horas para formação do piloto instrutor de voo em aeronave C-99 entre os anos de 2012 e 2015. Utilizou-se uma pesquisa descritiva com base documental. As informações de esforço aéreo, obtidas no Sistema Ópera, e das horas voadas pelos pilotos até o momento do conselho de voo operacional a instrutor, encontradas na ata do conselho, foram apresentadas por meio de tabelas, feitas as análises, e, após, correlacionadas pelo coeficiente linear de Pearson (r = – 0,15). Com o resultado, é possível verificar que há uma relação negativa fraca entre as variáveis, ou seja, a redução do esforço aéreo não impactou na formação do piloto instrutor pois, os pilotos atingiram o mínimo de 600 horas estabelecidos pelo PIMO. Diante disso, fundamentado pela Teoria das Restrições de Goldratt, na sua primeira etapa de identificar a restrição, pode-se concluir que a redução do esforço aéreo não foi o gargalo no processo de formação do instrutor.

Palavras-chaves: *Esforço Aéreo. Treinamento. Experiência. Piloto Instrutor. Teoria das Restrições.*

1 CONTEXTUALIZATION

The First Squadron of the Second Transport Group (1st/2nd TG) is subordinated to the Fifth Air Force (V FAE), responsible for air transport within the Aeronautical Command (COMAER). That unit, named CONDOR squadron, operates Embraer 145 model aircraft, called C-99A by COMAER. V FAE was created in 1959 and aims to carry out the specific actions of logistics air transport, such as: air exfiltration, air infiltration, logistics, logistical air transport, besides complementary actions such as special transportation. It also aims to continue the training and instruction of its operational and maintenance teams, enabling its staff to work in combat and supervising the planning and execution of the technical-administrative activities of the Unit (BRASIL, 2015). The 1st/2nd TG has military personnel belonging to the crew scheduling (CS) on board: pilots, flight mechanics, avionics maintainers and flight attendants. It must be emphasized that only aviator officers can be pilots.

The Operational Instruction and Maintenance Program (OIMP), under the responsibility of the 1st/2nd TG is the formal document that plans the air activities sized in specific training to be carried out by all crew members, in order to keep them trained and efficiently standard capable of operating the aircraft in visual flight conditions (VFR) and by instruments (IFR) for both domestic and international flights (BRASIL, 2015).

After analysis of OIMP 2015 and observation of the training and operational elevation criteria of pilot flight instructors of the 1st/2nd TG, it is noticed that the marks attainable for raising the levels of operational classification are mainly guided by the theoretical tests and the number of flight hours. Thus, the pilot begins the operability as a student, moves on to basic pilot (BP) after reaching 80 flight hours, operational pilot (OP) after reaching 300 flight hours and, finally, flight instructor (FI) after reaching 600 flight hours.

Comparing the operational requirements with the length of stay of the military personnel in the squadron, it is possible to verify that the pilot reaches the maximum flight instructor operability when the following requirements are reached: being an operational pilot; performing for at least one year as an operational pilot; attending preferably the fourth year of the AU; having at least 600 hours flight hours on the C-99 aircraft; having preferably taken the Flight Instructor Standardization Course; successfully concluding the aircraft system test; flight simulator; aerial practice and being approved by the operational flight board[1] (OFB). From this on, the pilot will be responsible for passing on knowledge to other pilots.

The flight hours available for the AU are ruled by the Aeronautical Command Instruction (ICA) 55-87- COMGAR operational activities program, which are updated annually. From 2012 to 2015, there was a gradual reduction in the air effort compared to the amount of instructor hours from 2008 to the present year, further enhancing the air effort starting from 2015. Hence, the air unit faced a significant loss and it was necessary to adjust the distribution planning of hours per crew member.

Considering the facts mentioned above, this article aims to analyze the relation between the continuous air effort reduction and the consequent possibility of affecting the operational elevation, training and experience of pilots. When analyzing training as a dependent factor of the guidelines icluded in OIMP, it is expected and predictable that flight hours restriction will decrease pilot training and experience. Mager (1979) says that training is a solution, a remedy that

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[1] OFB: Advisory body of the Commander of the 1st/2nd TG whose purpose is to evaluate the performance of flight crews, qualifying them in accordance with the established requirements, and to assist the Commander in matters pertaining to the fulfillment of the Air Unit (AU) mission.

involves information trasmission in order to modify the knowledge or ability of an individual to do something, that is, the instructor must be trained so that he can teach and make the right decisions at times of increased workload during the flight.

It is established by the Flight Instructor Training Course a minimum of 600 flight hours on the aircraft. As it happens the continuous reduction of flight hours allocated in the squadron can affect this requirement, directly impairing the training of pilot instructors. In this sense, this work aims to examine how the air effort reduction can interfere in the number of hours for operational elevation and the qualification of the flight instructor.

Considering the facts mentioned above, the following question arises from the research: What is the impact of reducing the air effort inrelation to the number of hours for the flight instructor pilot training on the C-99A aircraft of the 1st/2nd TG between 2012 and 2015?

To guide this research and answer the above inquiry, the following Guiding Questions were elaborated(GQ):

GQ1: What is the air effort for the squadron from 2012 to 2015?

GQ2: How many flight hours on the aircraft did each pilot have, at the time of the operational elevation to instructor, between 2012 and 2015?

In order to answer the research problem, the general objective is to identify what happens to the pilot of the 1st/2nd TG when the impact of the air effort reduction occurs in relation to the number of hours for operational elevation to C-99A flight instructor.

The following specific objectives (SO) have been drawn up in order to answer the guiding questions:

SO1: Identify the air effort allocated to the squadron from 2012 to 2015.

SO2: Identify the amount of flight hours on the aircraft that each pilot had at the time of the operational elevation to instructor, between 2012 and 2015.

This research has scientifically analyzed the parameters of operational elevation to flight instructor of pilots between 2012 and 2015 and enables the squadron to direct efforts to adapt the OIMP and better prepare for the scenario trend for years to come. In addition, this study will serve to guide other works aimed at the flight safety, in which crews with less flight hours should have a more accurate situational awareness and more frequent flight simulator training than the currently one, which may also be applied to other air units of the Air Force.

2 THEORETICAL REFERENCE

The research was based on the concepts of the Israeli physicist Eliyahu M. Goldratt who developed the Theory of Constraints (TOC) with the proposal of continuous improvement of the processes based on the analysis and treatment of the constraints, to eliminate obstacles in order to achieve a goal and, thus, improve the planning and the control of the organizations.

Cox III and Spencer (2002) say that production system consists of a series of successive steps performed through different resources. It is necessary to identify the system to be studied in this research so that the Theory of Constraints can be used as a scientific tool. Considering the necessary demand of the 1st/2ºTG to carry out the training of flight instructors in the C-99 aircraft, the whole process that involves this goal (GOLDRATT, 2002) should be evaluated.

The operational requirements established at OIMP of the AU are parts of the process that make it possible the pilot operational elevation. Such requirements are interdependent elements of the whole process. TOC equates this relation in comparison with a chain operation, in which the weakest link determines the restriction of all the others. This study focuses on one of the constant requirements for instructor training which is to have the minimum number of flight hours, emphasizing that the difficulty in achieving this condition is defined as a constraint in the system mentioned above. Thus, one must direct efforts to the weakest link, study it and adapt it so that the chain is strengthened and will contribute to check the impact of air effort reduction on the operational elevation to pilot flight instructor on the aircraft C-99 of the 1st/2nd TG, enabling the improvement of the process when reaching the first stage of the TOC.

In order to better explain the theory, Goldratt divides it into five steps:

1 - to identify the system restriction: point out what can prevent the organization from achieving its goal. In this research, the necessary requirements to train the instructor were listed in order to identify the system. After that, the restriction that compromises the flight instructor training will be verified, completing step 1;

2 - to decide how to exploit the system restriction: it means taking advantage of existing capacity in the restriction, adopt preventive maintenance practices, short-term actions, in order not to stagnate the formation of the FI, without ignoring the other requirements;

3 - to make everything subject to system restriction: align the entire system or organization to follow the pace of the constraint. The other requirements of operational elevation should strengthen the weakest;

4 - to raise the system restriction: changes must be implemented so that, even with the restriction, the capacity is increased. Invest in the weakest link so that the formation of the FI is continued;

5 - if the constraint is broken, go back to the beginning: if the restriction is voided, another item may be a new restriction; go back to step 1 to identify whether another constraint may cause the process to become inert.

The AU planning has become more laborious. Dividing flight hours between crew members equally so that everyone can fly a minimum of desirable hours to maintain constant training was a difficult task due to the air effort reductions that occurred annually.

According to Mager (1979) when a skill decreases appreciably as time passes, a suitable solution would be a skill maintenance program, considering the exercise of practice as a form of improvement. Thus, it is important that the squadron again receives greater amounts of aerial effort again so that pilots maintain practice and training and, consequently, achieve higher levels of training, because, according to Taylor, Kannedy, Noda & Yesavage (2007), experience can be categorized into three types: minor, moderate and larger. The authors explain that each category progressively requires advanced training and more flight hours experience. They also state that the highest levels of experience are associated with greater total flight hours (our translation).

3 METHODOLOGY

Based on Gil's classification (2002), in order to achieve the general objective, this scientific research is classified as descriptive, focusing on establishing a relation between two variables: the air effort destined to the squadron and the number of hours for operational training of the flight instructor pilot.

This is a documentary research, following the line of the same author to outline technical procedures. The primary sources for analysis will be manuals and documents from COMAER, specifically within the Military Organization (MO).

Three different data sources were consulted. The first one was OIMP, a document that includes the requirements for operational elevation. The second source was the Opera System[2], which has the allocated air effort for each year. The third one was the instruction subsection of the 1st/2nd TG, which provided the amount of flight hours each pilot had at the time of the OFB.

This study was intended to present the reductions in the flight hours destined to the squadron and the reason why this did not happen, because it would require further in-depth study. However, it is worth mentioning that Brazil was going through economic and political crises that will not be discussed.

The Theory of Constraints published in the Manual of The Theory of Constraints (Cox and Spencer, 2002) was researched to support the concepts presented in the theoretical reference of the work.

Thus, the line of research is Education in the Air Force, because the training and specialization of eight officers who completed the operational training of pilot instructor in the fourth year of the UAe between 2012 and 2015 was studied.

In order to answer the first GQ, a documentary consultation was made in the Opera System to know the number of hours flown by MO each year between 2012 and 2015.

To answer the second GQ, the amount of flight hours each pilot had at the time of operational elevation was found at the operational board minutes in the squadron's Instruction Subsection, located at Galeão Air Base.

The data were inserted in the Microsoft Office Excel 2011 program to enable the creation of charts and spreadsheets which facilitated the reader understanding. The hours related to the air effort flown by the squadron annually, were used to draw up a graph of the gradual air effort reduction. The hours flown per pilot up to the date on which the operational elevation to flight instructor occurred have been transformed into a table. In the same program, Pearson statistical function was used, providing a numerical result called correlation coefficient (r) in which it associates two quantitative variables measuring the direction and degree of the linear relation between them, and the result can be between -1 and 1. This number will be the degree of correlation, that is:

r = 1 means a perfect positive correlation between the two variables.

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[2] Internal system used to record squadron flights.

r = - 1 means a perfect negative correlation between the two variables, which means that if one increases, the other always decreases.

r = 0 means that the two variables do not depend linearly on each other or there may be a nonlinear dependency. Thus, this result should be investigated by other means.

Finally, it is understood that positive values of the coefficient , i.e., between 0 and 1, indicate a positive and true correlation between the variables and, then, the identification of the constraint. Negative coefficient values, between 0 and -1, indicate no correlation between the variables, denying the existence of the restriction. Thus, it was possible to finish the first stage of TOC and present the impact of air effort reduction on the operational progression of the flight instructor pilot, as well as pointing out the effects on training and experience of the squadron pilots.

4   DATA PRESENTATION AND INTERPRETATION

The analyzed data made it possible to present the results so that it was attainable to identify the

impact of the air effort reduction on the number of hours for operational progression of the flight instructor pilot, taking into account the period which was researched.

Figure 1 was elaborated to answer the first GQ. It presents the annual air effort of the squadron, obtained in the Opera System, between 2008 and 2016. The hours made available for the squadron to fulfill their missions, to prepare and maintain the operability of the crews decreased 34.6% between 2012 and 2015, fulfilling the SO1. It is noteworthy that the pilot who became an instructor in 2012 started the air activity in 2009. It is possible to affirm that the air effort has been decreasing since 2008, and in 2016, it was three times lower.

Goldratt (2002) states that the goal of the five steps focusing process consists in allowing that the system can undergo a process of continuous improvement through the constraint identification and management.

Figure 2 was made to answer the second GQ, which shows the hours flown by pilots at the time of the operational flight board and the average of those hours per year.

Figure 1 - Annual Air Effort.
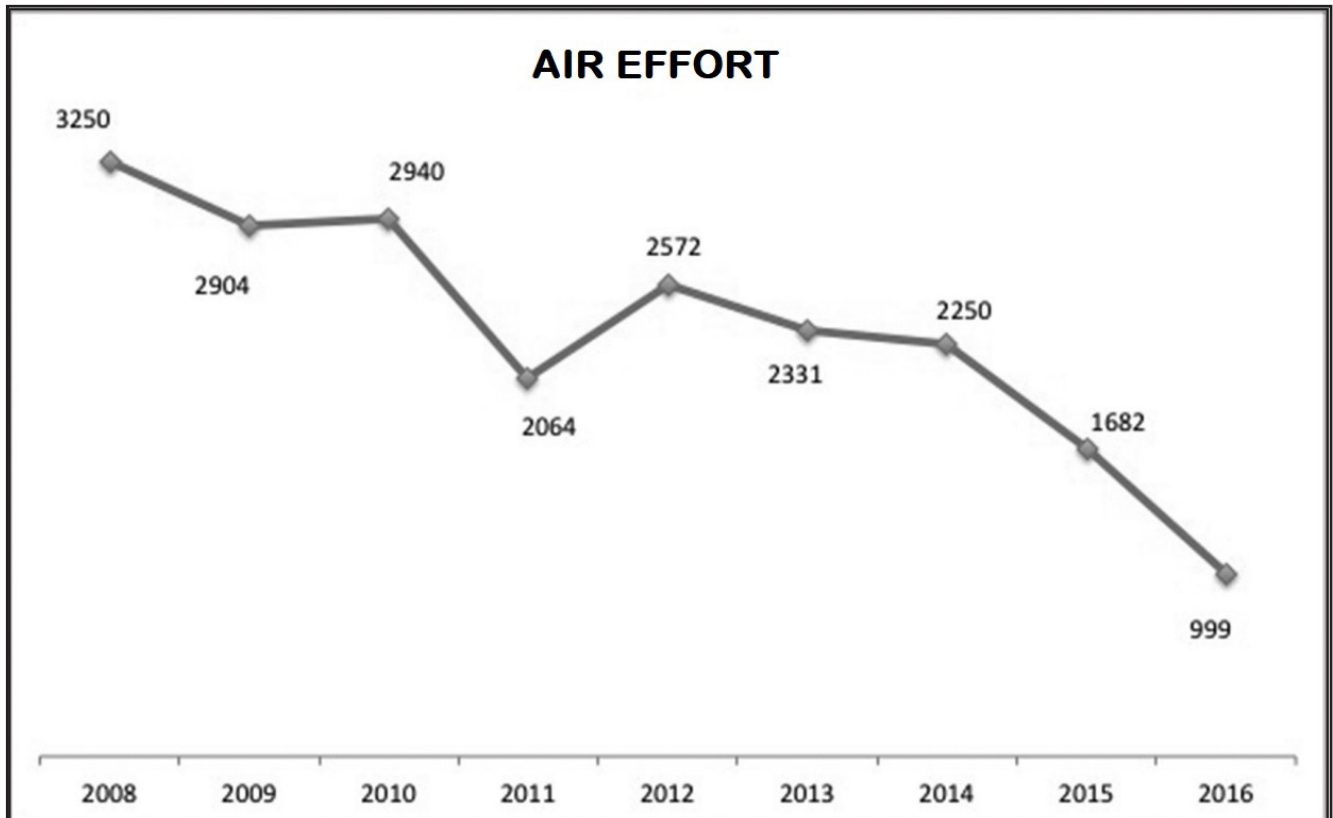
Source: The author.

Figure 2 - IN training per year, pilots, flight hours at OFB, annual average at OFB and annual air effort.

YEAR IN	PILOT	HR	AVERAGE	AIR EFFORT
2012	1	792:25	792:25	2572
2013	2	690:10	701:25	2331
	3	712:40		
2014	4	734:10	713:32	2250
	5	692:55		
2015	6	772:45	767:50	1682
	7	810:00		
	8	720:45		

Source: The author.

Figure 2 shows in the first column the year in which the elevation to instructor occurred. The second column refers to the pilots who participated in the survey and the third column includes the number of hours flown up to the time of the operational flight board to be an instructor. It is noticed that the annual average increased between 2013 and 2015 and the air effort has decreased over the years. The reason for this increase has not been researched and may be the subject of future studies, as the number of pilots who flew between 2008 and 2015 varied greatly each year. These variables were not necessarily addressed in this article.

The fourth and fifth columns were inserted in Figure 2, respectively, average of the hours flown from column 3 and aerial effort. The hours in column 4 were transformed into absolute numbers and so the table was created as it can be seen in Figure 3.

From the last table, it was possible to use Pearson statistical formula, relating the first column to the second one. The result was $r = -0.0291$. Dancey and Reidy (2005 apud Figueiredo Filho; Silva Junior, 2009), explains that the values of $r = 0.1$ to 0.30 indicates a weak degree of correlation and together with negative signal, provides a negative direction condition of the relationship. Therefore, the result reveals a weak relation added to the negative condition between the two variables.

In view of the analyses made, the pilots exercised the practice of continuous flight between 2012 and 2015 and reached the minimum set in the squadron for instructor training. Such context is aligned with Taylor, Kannedy, Noda & Yesavage (2007), which states that the flight experience is proportional to the amount of flight hours and the time lapse that pilots fly aircraft.

In the first stage, in accordance with TOC, it was identified that the reduction of hours available to the squadron was not a restriction on the number of hours for operational progression from pilot to instructor. Therefore this is not the weakest link in the chain among the requirements established at OIMP. Thus, the first stage of the theory is concluded based on this observation. However, it should be considered other requirements in the formation that can be analyzed by other researches aimed at detecting this constraint.

According to Mager (1979), it is possible to state that the skill of the instructor pilot was exercised through practice and that are adequately trained because it is necessary that the function continues to be performed frequently.

Figure 3 - Air effort and annual average at OFB.

AIR EFFORT	HR
2572,00	792,41
2331,00	701,41
2250,00	713,53
1682,00	767,83

Source: The author.

5 CONCLUSION

The figures presented in the analysis show a scenario for available hour reduction to the air unit and, even so, the operational demand of the 1st/2nd TG requires the continuation of the training, formation and operational capacitation of the crew members.

The continuous decrease in flight hours available for the 1st/2nd TG led to the identification of the impact of the air effort reduction on the number of hours for training the pilot flight instructor on the C-99 aircraft between 2012 and 2015, due to the possibility of not reaching the minimum of 600 flight hours established at OIMP.

In order to meet the general goal, the following specific objectives have been set up: 1 - Identify the number of hours flown at the squadron between 2012 and 2015; 2 - Identify the number of flight hours on the aircraft each pilot had at the time of the instructor operational elevation between 2012 and 2015. The specific objective 1 showed that there has been a continuous reduction in the air effort of the AU since 2008. The second specific objective provided the hours flown by the pilots up to the time of the OFB, in which an increase is noticed from 2013. All collected data has been entered in the Microsoft Excel program so that one can apply Pearson statistical calculation and provide the result of the correlation between the air effort and hours flown by the pilots, besides enabling the preparation of the spreadsheets.

Thus, it was possible to identify that, during the flight instructor training process, from the perspective of the first stage of the Theory of Constraints, that the constraint was not the gradual reduction of air effort because it did not directly impact the number of hours required for the operational elevation of the crew members since, even with the air effort reduction, the hours flown per pilot remained above the minimum requirement established at OIMP.

This research is important because it gathers two essential factors for an instructor pilot: training and experience. The flight instructor should be able to train the second pilot[3], that is, to the learning student, the correct and safe way to fly an aircraft and, in addition, to be able to pass on information and experience, in order to perpetuate these teachings for the next generations who will work at the AU and will also participate in the fulfillment of the mission of the 1st/2nd TG.

Thus, this study allows that others studies analyze the necessary skills for the flight instructor pilot, in order to adapt OIMP and the influence of the decrease of hours on the situational awareness of the instructors or the motivation of pilots in relation to the scenario of the air effort reduction. Thus, the knowledge generated by this research will be available to be used as support for future decisions in which the optimization of the Air Force processes, even with fewer resources, have the crews trained and ready for the immediate deployment when necessary.

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[3] Considering that the aircraft is manned by two pilots, one is the instructor and the other one is the second pilot.