CONSIDERATIONS ABOUT THE FUTURE FIGHTER PILOTS DEVELOPMENT

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Abstract: The present training aircraft used for fighter pilots development is not able to offer to the students the possibility to acclimate to maneuvers performed at high G overloads, to provide the training needed to perform the air to air refueling missions or to provide the tactical training with the new survival systems. So it is mandatory to develop a new training system, that it will be able to meet those new requirements.

1. INTRODUCTION

The purpose of this analysis is to identify the performance requirements, training tasks and standards that pilots have to meet to be admitted to the initial qualification programs for fifth fighter aircraft generation.

The entry into operation of the fifth fighter aircraft has produced a major change in institutionalized training and has prompted Air Forces from NATO members to reassess its current training system and adapt it to new requirements. In this context, the United States Air Force (USAF), the NATO's most important air force and, at the same time, the first entity to have felt the effects of launching the F-22 Raptor, asked the RAND Research Institute to assess the capability of the own current training system, consisting of the binomial aircraft and training programs, to ensure if the training pilots is in line with the new requirements. The study was finalized after two years of research, and its findings in the final report highlighted the fact that future air operations will lead to a change in the combat pilots training system, but without specifying what performance and capabilities are expected from the school aircraft to support new training requirements. The study proved to be extremely necessary and helped the responsible entity in making well-documented decisions about keeping or replacing institutionalized training programs or current school aircraft. In response to RAND Corporation's research, the Air Education and Training Command (AETC) has begun its own research study on the functionality of the institutionalized training system, a study later supplemented by an analysis of the present and future requirements it has to meet.

2. CONSIDERATIONS RELATING TO THE COMPETENCES REQUIRED FOR FUTURE PILOTS OF FIGHTER AIRCRAFT

Taking in account the experience of NATO partners about the impact of the new combat aircraft over their training systems, the Romanian Air Force needs to adapt its own institutionalized training system in time so that, with the purchase of fifth generation fighter aircraft, expected from 2030, to be capable of providing pilots with training appropriate to the actual training requirements and to facilitate their passing on aircraft to upper generation combat aircraft.

In this spirit, I believe that addressing this issue is a necessity for both the present and the future Air Force, and finding viable solutions prior to the acquisition of new combat aircraft would allow timely distribution of budget effort, thus avoiding financial pressure greatly exerted on the system in a short period of time. Also, an early approach to the subject provides the time to identify dysfunctions and to regulate the system effectively.

To assess the capacity of the current training system to provide training needs of pilots generated by modern aircraft, a comparative analysis of the skills that the current system develops to pilots in Advanced Flight Training (AFT) and Introduction to Fighting Fundamentals (IFF), with those required for admission to the qualification program on modern combat aircraft has been carried out. Lower Teaching Stages, Selection and Initial Flight Training (Screening and Initial Flight Training-IFT) and Basic Flight Training (BFT) are not relevant to this analysis because they are addressed by all pilots and are not influenced by the requirements of combat aircraft. Therefore, the minimum set of skills required to be accumulated during the lower stages of training will remain the same for all pilots, and for those who will be oriented to multilevel aircraft, the competencies accumulated in the higher stages of training are relevant.

Starting with 2030, the Romanian Air Force intends to acquire the first multi-fighter F-35 combat aircraft and, implicitly, to begin the training of the first series of students who, immediately after completing the introductory phase of the basic tactics (IFF), under the institutionalized training, they will access the initial qualification on the F-35A. This first class will be the beginning of the training of Romanian pilots for the fifth fighter aircraft`s generation, and from then on a constant annual increase in the number of pilots will have to be expected on the F-35. These pilots will need some skills to exploit this aircraft, skills that will somehow differ from the skills required today's combat pilots. At the same time, the Air Force inventory will move from the fourth generation to the fifth generation of combat aircraft, and budget efforts will be considerable.

Therefore, the current pilots training system, from the selection phase through the institutionalized training stages and finalizing the IQT initial qualification stage, may need to adapt to the new student preparation requirements for the future air operations. To this end, it is necessary to have a documented analysis of the training requirements specific to the new aircraft, identifying the type of competencies required for future students to exploit future combat aircraft, and an assessment of how the current system prepares and develops the necessary skills.

As the F-35 specific training program may be subject to changes according with future aircraft development programs, we started research from the existing *F-35 Aircraft Training Program* and we tried to cover potential future changes and in support of this we formulated some hypothesis like the number of flight training missions and their duration will be similar to those for the F-16 aircraft. Based on this hypothesis, there will be a finite number of skills and competencies that a student will have to achieve within the Initial Qualification Course on the multilevel aircraft. Following this, identifying the minimum set of skills required to complete the course must be done through "inductive logical reasoning", starting from the minimum skills and competences required to enter the training course, from the number of flight training mission, from the number of exercises performed at simulator and their time allocated, and last but not least, by combining new skills necessary for pilots to operate and efficiently use new equipment and systems introduced on the multirole aircraft.

In order to determine possible deficiencies in the training system, we compared the minimum set of competencies identified to be required by pilots to be admitted to the Initial Qualification Training course and the set of competencies accumulated and certified today, with the completion of the Introduction to Fighting Fundamentals course (IFF).

To determine how these discrepancies can be eliminated, the present study identified flight safety as the main element of analysis and the effectiveness in conducting combat action as the secondary one. Flight safety has as its primary objective the reduction or avoidance of unacceptable risks as well as the exposure of the pilot student to situations where inherent errors may occur which may have undesirable major effects.

If a deficiency can be identified as a result of the analysis that could create a flight safety issue, then the way to be solved will be translated into the necessary competence to be acquired before the initial qualification course on the aircraft.

Since the field of development and training of combat pilots is complex and implies a lot of variables, and research work requires good organization, the basic skills necesary for a pilot to successfully complete the training can be distributed in four major categories, depending on the field addressing them as follows:

•   category of skills required for piloting and controlling the aircraft;

•   competence category for knowledge, understanding and application of flight principles and regulations;

•   the category of competencies required to manage the information on board and make the right decisions;

•   competence category specific to combat aircraft pilots.

This systematization of the database is absolutely necessary, taking into account that the F-35A aircraft Training Development Team has identified over 3500 individual tasks required to be executed by a pilot along the training program for obtaining the mission qualification, starting from take-off to the use of night-time weaponry. After simplifying the management of this large amount of data from these four categories of competencies, it is necessary to identify the shortcomings that the current system has in relation to the new training needs.

Knowing the exact number of skills required to obtain each basic skill and the number of repetitions according to the training program needed to develop a certain skill is not so important, but identifying a certain type of skills and the level of performance required is essential. Therefore, the grouping of competences in the four categories based on performance standards, corresponding to the areas mentioned above, has proven to be extremely useful and necessary. To determine pilots' level of training, the Air Force has standardized the assessment of their performance in techniques of flying, instrument flight, flight performance as an instructor or as an assessor. In all cases, through examinations planned or decided by commanders, the performance of the pilots in the performance of missions for which they are qualified is assessed. Also, according to the RAND Corporation study, an important feature of future operations will be the ability of pilots to handle a large amount of information received on board aircraft as well as the ability to interpret them. Competencies in the category dedicated to piloting and controlling the aircraft are the basic skills necessary for any pilot to progress in training. For each aircraft, a certain level of training is required for the pilot to exercise control, but the foundation in flight technique is provided by the stages of training on classical school aircraft. In the advanced training phase, the student continues their training, but training focuses on the development of other competencies, specific to the combat pilot. Within the IFF, training is polarized on the development of competencies in the "Competence specific to combat aircraft pilots" category, as the pilot is already wings awarded and has the competency specific to the category dedicated to piloting and controlling the aircraft, but only to be maintained by training. Finally, we can conclude that the current training system provides the student at the end of the IFF stage with the level of performance needed to address the IQT program for the fourth-and-fifth-generation multirole combat aircraft.

Competencies in the category of knowledge, understanding and application of flight principles and regulations, as well as those in the category dedicated to piloting and controlling the aircraft, are also well developed by the current training system. The assessment of skills in the knowledge, understanding and enforcement of flight and regulatory principles starts from the first day of the first training phase and continues until the end of the career. Air Force polarizes the training provided in each stage or phase on the development of this category of competencies, and aims to the student responsibility in preparing and executing missions as their flight experience will increase. These expectations are much more evident in the case of combat aircraft pilots in solo flight, where the accurate flight execution and situational awareness is the responsibility for only one person, its mission becoming more complex and requiring a high level of performance. To successfully accomplish this, instructors should permanently evaluate and correct pilots' performance during training, regardless of the phase or stage, thus assuring students the development of basic skills in this category. In conclusion, we can state that, from the point of view of this category of competencies, there is no deficiency of the current training system in relation to the specific requirements of the fourth-and-fifth generation of multirole combat aircraft.

The category of skills required for *Cockpit Resources Management (CRM)* and *Decision Making (DM)* is one of the those two categories for which students are poorly trained during institutionalized training stages and the assumption of a required level of their performance after completing basic tactical training and before approaching the initial qualification course on the combat aircraft is little unrealistic in this respect.

Regardless of the aircraft analyzed, the pilot, during the flight, is required to receive information and data, process them to make the right decision and to execute the actions accurately. Moreover, the amount of information received on the board of the modern aircraft will be much higher than any other aircraft in the past, and assessing pilots' ability to manage this information is very important in training them. CRM includes many more tasks to be performed onboard of combat aircraft and it is not limited to information and sensor management, but thanks to the advanced data exchange technology implemented on multi-aircraft aircraft, this study focuses on these latest aspects of CRM , in order to highlight the need to develop pilots' capacity to handle a large amount of information and data onboard during the flight. All these resources provide a wealth of information, and it is imperative that the pilot is able to manage, interpret and identify their source. Thus, in the case of fourth and fifth aircraft generation, the pilot will receive both on-board sensors and data links from terrestrial and/or other aircraft in the air. Processing all this information, maintaining aircraft control and monitoring the action environment is a complex and difficult task that requires dedicated training before aircraft qualifications course begins.

A key component of the management of information and sensors is the prioritization. Prioritization includes knowing the exact moment of use of a sensor, weapon, or information which are received at a moment in time. Therefore, this study focuses on the type and amount of information received by a pilot at each stage of training and how well the current training system for modern combat aircraft is prepared from this point of view.

However, the most important deficiency of the training system prior to commencing training in the combat field, is the level of those specific skills developed for the combat aircraft pilots. First of all, developing these skills before approaching training on an airplane only with a simple, constructive design is, ultimately, a safety issue. Without an intermediate training program on a dual command aircraft, students will have to go directly from the school aircraft to a state-of-the-art combat aircraft.

The school aircraft has very good flight characteristics for the aviation category it belongs to, but the performance and systems on board are far from modern combat aircraft. Obviously, the training system is not able to offer to the students the possibility of acclimating to maneuvers performed at high overloads, to provide the training needed to perform refueling missions in the air or tactical training with new hostile survival systems such as Distributed Aperture System, as well as missions for recognition and suppression of enemy ground defense (SEAD).

The new fighter aircraft`s development programs are in a still going on and the new technologies used onboard combat aircraft bring new missions for which students must be trained, leading to a high density of training events to be performed in a time-frame well defined and unmodified in accordance with the new requirements. The consequence of this development is the need to resize the number of events in the training categories already existing in the IQT training program and to overburden the students by increasing the number of skills that need to be accumulated in a short time. That is why the existence of a training system able to provide the necessary preparation for the students from all stages would provide a relaxation of the IQT program and, implicitly, a resource saving, given the high cost of operating the multirole aircraft.

3. CONCLUSIONS

As technology advances and its impact on pilots development and training is becoming more and more enhanced and with immediate effects, I believe that future research studies in this area are absolutely necessary. Taking into account that new combat aircraft benefit from flight control equipment and systems which allow for network flight performance beyond the old aircraft and which requires a much less effort from pilots to maintain aircraft control, analysis of the possibility of eliminating training events in the category of competencies dedicated to maintenance of aircraft control and allocation of appropriate resources and time to the categories of competencies for which the deficiencies of the current training system were found.

Another solution to mitigate the differences between the institutionalized and the operational training stage is to allocate more solo flight missions as the student gains more confidence in his / her possibilities and manages emotionally better the contact with the fighter aircraft.

Also, training in the execution of certain tasks, intended to be performed in flight, must be transferred from the aircraft to the simulator. The student must safely execute all maneuvers in flight, but the introduction of specific CRM elements must be done much earlier in the flight simulator. Simulator training involves a much lower consumption of resources, and the instructor can concentrate on training only on items that are found to be deficient.

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