

EVALUATION OF TACTICAL MISSION EXECUTION

Adam BONDARUK*, Jarosław KOZUBA**,

* Faculty of Aviation, Polish Air Force Academy, Deblin (a.bondaruk@wsosp.pl),

** Faculty of National Defence and Logistic, Polish Air Force Academy, Deblin
(j.kozuba@wsosp.pl)

DOI: 10.19062/2247-3173.2017.19.1.7

Abstract: *Training of flight crews, particularly in combat aviation is a complex and long term process. It requires the use of a standardized methodology in order to evaluate the mission execution in each of the training areas. Because of its complexity, tactical mission is the most difficult and demanding task to perform. It combines aircraft handling, procedural and tactical elements. Maintaining situational awareness at the minimum level required reflects the quality of preparedness (training) of the flight crew. Periodic inspection and ongoing evaluation are indispensable tools for confirming the correctness of the solutions adopted in tactical training of flight personnel.*

Keywords: *flight training, situational awareness, training methodology.*

1. INTRODUCTION

Training flight personnel in combat aviation is, due to their intended use, a process with a high degree of complexity, which increases with the application of new, technologically advanced tactical systems. Operational capabilities of the fourth and fifth generation multi-role aircraft undergo a continuous development. The factors which limit crossing the subsequent barriers are psychomotor (operator's) skills of the flight crew. Despite the automation of the decision-making processes in use, which ultimately provides the processed information, the sheer amount of that information often exceeds the pilot's perceptual capabilities. The main objective of the air training is to prepare flight crews, in the shortest time possible, to effectively execute combat missions in accordance with their intended purpose.

2. FLIGHT TRAINING AREAS

Flight training can be divided into three main areas [1]:

- flight maneuver training;
- procedural training;
- tactical training;

Flight training syllabus should ensure the implementation of training in the order specified yet the areas of training overlap at certain stages. The degree of their implementation depends on the main objective and the complexity of training, as well as on the level of training of a particular pilot. Training of emergency flight procedures is implemented throughout the entire flight training program, including simulator training.

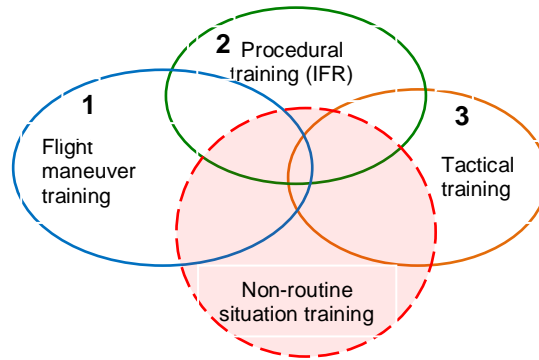


FIG. 1. Flight training areas.

The primary objective of the first area (flight maneuver training) is to master aircraft handling. Its purpose is to develop a "muscle memory" (habits) of the pilot and the multitasking skills appropriate in various flight phases (takeoff, climb, flight maneuvers, descent, landing). In the second area (procedural training), the pilot focuses on the procedures of performing the flight in the airspace according to the rules (regulations) applicable to all aircraft, and on the ability to interpret information coming from available sources describing the situation in the airspace (radio-navigation instruments, departure and arrival cards, information from the ATC, etc.). Its objective is to master the procedures and techniques applied in various phases of an IFR (procedural) flight.

The objective of the third area (tactical training) is to master the techniques of tactical maneuvering, mutual support in formation, data interpretation and the use of all tactical systems of the aircraft. In the course of that training, the pilot commences to build tactical situational awareness.

3. LEVELS OF SITUATIONAL AWARENESS.

Situational Awareness (SA) is the perception of the environment, adequate for the current status/phase of the flight, understanding the importance of elements perceived, and predicting the possibility of changes in their status in the nearest future [4].

According to M. Endsley [6], situational awareness has three levels, depending, among other things, on the degree of the pilot's training (operator's capabilities).

Level 1 is characterized by the pilot's ability to perceive (record) the current situation of the aircraft, as well as the changes of the flight, environmental (weather conditions), and operational parameters. This means that the pilot does not understand their interrelations and the resultant consequences. This is a very undesirable state, causing the deepening of the errors the correction of which exceeds the operator's skills (psychomotor) of the pilot.

At Level 2, the pilot understands the current situation, he is able to synthesize and analyze the information coming from all available sources, and to introduce changes (make a decision) in order to achieve the intended goal (the state of the flight), but in a very tight time margin. This means that the pilot sees, understands and corrects, the deviations from the desired state which occur, and his operator skills allow him to perform the flight (task) safely but with reduced efficiency (proficiency).

At Level 3, on the basis of an analysis of the available information, knowledge, and experience, the pilot is able to predict the development of the situation and to take the optimum decision in terms of achieving the objective of the main task.

This means that his operator's skills allow him to anticipate the consequences of the decision in the long time frame (at least several steps in advance). The mission is executed safely, efficiently, and with due proficiency.

4. MISSION EVALUATION

The evaluation of air mission execution is done on the basis of the standardization/evaluation instruction and other publications containing rating standards (training syllabi and methodologies) The program of flight crew evaluation verifies qualifications of personnel, and provides the efficient use of resources, and standardization of executing operational missions. Ongoing evaluation concerns each mission (flight) during the training process (e.g. primary flight training). Periodic evaluation is conducted in accordance with the relevant regulations.

Tactical training is the most difficult and demanding stage, which combines a wide range of skills from all areas of training. The objective of evaluating a tactical mission execution is to verify the correctness (in accordance with the accepted standard) of the tactical systems use. Periodic inspection of tactical mission applies to pilots, who maintain the CMR (Combat Mission Ready) and BMC (Basic Mission Capable) levels. During primary flight training, the pilot acquires the necessary tactical skills, which are verified on an ongoing basis by the instructor. The instructor assesses whether the trainee has achieved the level of tactical situational awareness which is required in a given training module.

In aviation, various rating scales are used in order to evaluate the mission execution. It is important that each instructor or evaluator understand the meaning of a particular grade identically. In periodic evaluation of tactical mission execution, a two or three-degree rating scale ("Q" qualified, "Q-" qualified minus, "U" unqualified) is adopted.

The particular grades shall be understood as follows [2, 3]:

- "Q" means that the pilot under evaluation both demonstrates the appropriate knowledge and also performs practical tasks in accordance with the accepted standard within the limits of the adopted (acceptable) tolerance;

- "Q-" indicates that the pilot under evaluation does not exceed the allowable tolerance in the individual areas, and does not breach either the conditions of the mission execution or safety. He requires, however, a detailed discussion or training, the scope of which is to be specified by the examiner;

- "U" means that the pilot exceeds the allowable parameters, resulting in a safety breach, or does not follow the accepted standards, which affects the performance of the task.

Combat mission execution evaluation is a mission whose scenario contains the tactics currently used by a given Air Force unit in accordance with its tasking/mission. The pilot under evaluation performs a formation flight in the position adequate to his level of training, e.g. the flight lead leads a four-aircraft formation. During the flight, the evaluator may change the formation, the master objective, however, is to evaluate the highest rating held by the pilot (the wingman may conduct a pre-flight briefing which will be evaluated). It is advisable to evaluate the tactical flight during an exercise or transfer to another airfield.

According to regulations adopted in Polish Air Force, while commencing the evaluation of a combat flight, the examiner must determine all the areas to be evaluated, including [2, 3]:

- tactical plan,
- tactical execution,
- radio use/tactical communications,
- visual lookout/radar mechanization,
- tactical navigation at high, medium, and low altitude,
- ingress/egress procedures,
- timing (preplanned time on target, etc.)
- threat reactions,
- onboard tactical system utilization.

Each of these elements has its own evaluation criteria, which are included in the general definition of grading criteria. For example, for tactical execution area:

"Q" - Applied tactics consistent with the threat and current standards is quickly adapted to changing environment. The pilot executed the plan and achieved mission goals. Maintained situational awareness (Level 3).

"Q-" - Minor deviations from tactical plan which did not result in an ineffective mission. Pilot makes slow and minor changes in the tactics to adapt the tactics to changing environment. Low situational awareness (Level 2).

"U" - The pilot is unable to accomplish the mission due to major errors during execution of the plan. Situational awareness lost (Level 1).

Another example may be radio use/tactical communications area, where:

"Q" - Radio communications were concise, accurate and effectively used to control (command) the formation or describe the tactical situation.

"Q-" - Minor terminology errors or omissions occurred, which did not significantly affect situational awareness, mutual support, or mission accomplishment.

"U" - Radio communications were inadequate (not precise enough or excessive) causing degradation of situational awareness and mutual support, and significantly reduced mission accomplishment effectiveness.

The grading criteria in the visual lookout/radar mechanization area are as follows:

"Q" - The pilot demonstrates thorough knowledge and effective application of visual lookout/radar search techniques for all phases of flight while maintaining deconfliction contracts.

"Q-" - The pilot demonstrates limited knowledge of visual lookout/radar search techniques and does not establish responsibilities for individual formation members in all flight phases. There are delays in task allocation and minor deviations in deconfliction contract adherence.

"U"- The pilot demonstrates unsatisfactory knowledge and skills of visual lookout/radar search responsibilities, due to which he allows undetected enemy to penetrate and commence a short range fight, and fails to maintain deconfliction contracts.

The above examples point out to the fact that each instructor (evaluator) must use the same conceptual apparatus, as otherwise double standards may be applied, which is an intolerable situation. Evaluation of the mission execution on the basis of countable values is relatively simple as it requires only the observation of the relevant parameters.

Table 1. An example of countable parameter evaluation criteria [3]

Q	Altitude	+/- 200
	Airspeed	+/- 5%
	Course	+/- 5 degrees/3 NM
	TACAN Arc	< 3 NM
Q-	Altitude	+/- 300
	Airspeed	+/- 10%
	Course	+/- 10 degrees/5 NM
	TACAN Arc	> 3 NM
U	Exceeded Q- limits	

A more difficult task is to evaluate the areas in which it is necessary to assess whether the pilot achieves the required degree (level) of knowledge or skills. In such a situation, it is necessary to introduce a hierarchy of training objectives. Taxonomy is a classification that is based on clear principles. The aim of taxonomy in training is to classify training objectives, and, what it involves, to use an evaluation standard for uncountable values. This allows to define the goals which may (should) be achieved in individual training modules.

The starting point is to define the basic components (categories) that create and systemize the process of learning. There are the following categories of learning [5,7]:

- knowledge,
- comprehension,
- skills.

Knowledge is understood as the ability to accumulate (memorize) the information and to recall it. Comprehension is a general term referring to the ability to organize knowledge in a conscious (deliberate) manner. We can distinguish five levels in this learning category. Skill is the ability to perform physical or mental tasks while maintaining a certain standard. Each organization which conducts flight personnel training has its own uniform system of performance evaluation (classification), which is a combination of categories and levels and which is based on a rating scale consisting of two to ten levels.

During the evaluation of tactical mission execution, both periodic and within the scope of a programmed training, a minimum acceptable performance level of individual mission elements is specified. An example might be an evaluation sheet used for TI (Tactical Interception) mission evaluation, which is performed during the multi-role F-16 aircraft training. The rating scale is composed of five levels:

- 0 – the pilot demonstrates lack of knowledge or skills;
- 1 – the pilot executes the mission safely, but with limited skill (proficiency), which causes the need of the instructor's intervention in order to correct the resulting errors;
- 2 – the pilot executes the mission correctly, recognizes the errors committed and corrects them;
- 3 – the pilot executes the mission correctly, effectively and efficiently, commits minor errors which do not significantly influence the quality of mission execution;
- 4 – the quality of mission execution points out to above-average degree of skill.

The most common scale of assessments used in the Polish Air Force is a digital scale from 2 to 5 which will serve as a basis for a discussion of a mutual relationship between such features as flight safety, the level of the operator's situational awareness as well as training objectives.

The most important criterion for the evaluation of the performance of the task by the air crew is the criterion of safety. Each task conducted in the air has its safety conditions and the execution conditions which are specifically defined in the training programme (training methodology). Any violation of the pre-defined safety conditions must result in receiving an "unsatisfactory" grade, which results in the implementation of an appropriate procedure with regard to the pilot - either by suspension in flights or performing an additional flight under supervision. An important element of the assessment is finding an answer to the question why the safety conditions have been violated. The cause is the degradation of the operator's situational awareness to an unacceptable level one. The reasons may vary, starting with the lack of basic knowledge and understanding of the processes of mutual correlation between essential elements which affect a flight, fatigue resulting in impaired psychomotor skills as well as improper division of attention in particular elements of the flight. Receiving a partial "unsatisfactory" grade (2) due to the breaching of safety conditions results in an overall assessment mark - 2.

The pilot can receive an "unsatisfactory" grade in relation to the evaluated element due to a breach of execution regulations caused by lack of knowledge or insufficient skills. This also means that the operator's situational awareness has been degraded to level one. Such a case does not result in the introduction of sanctions in relation to the operator if it is a new element in the training process (training module). The final evaluation is dependent on the training target specified in the briefing.

Another criterion for defining the assessment is to identify the operator's situational awareness in a given area of training. This is inseparably linked with specific training objectives. The training objectives during a tactical training apply to the operator's skills, that is to the execution of the operator's activities in accordance with the adopted standards. Specifying whether a pilot who undergoes training possesses the required knowledge and understands the factors, affecting a tactical job, is carried out during ground training and a pre-flight briefing.

The quality of the air task performance (proficiency) is determined by the instructor in the course of the mission and in detail at a debriefing. Each case, when the pilot is unable to predict the development of the tactical situation (lags “behind”) and requires the intervention of the instructor (although properly reacting to “codewords”) points to level one of the operator’s situational awareness in the area of tactical training caused by lack of experience. This situation corresponds to the assessment of a “satisfactory” grade (3). The training objective is not achieved, however, this is a normal condition during the implementation of the training module.

The implementation of the tactical task during which the trainee pilot performs solo (does not require the instructor’s intervention) all the measurable and immeasurable elements in terms of not exceeding the permissible margin of error (Q-) points to level two of the operator’s situational awareness. In other words, the pilot notices errors and corrects them, without exceeding the conditions of task execution. This is an acceptable level which is required on completion of the training module, and during periodic pilots’ inspection in continuous training (of the trained ones). Such a situation proves the achievement of detailed objectives of the tasks, and corresponds to the “good” grade (4).

The task execution with flying colours, where Q requirements are not exceeded points to level three of the operator’s situational awareness (the desired one) and corresponds to a “very good” grade (5). The specific objectives of the tasks have been achieved on a proficient level, confirming the mastery of the pilot’s experience.

CONCLUSION

The rating adopted for the evaluation of the tactical mission execution corresponds to the categories of learning and stages of operators situational awareness. This means that in the tactical area of flight training in each training module there is a specified minimum level (rating), which must be achieved by the pilot if they are to be allowed to move on to the subsequent stage. It is usually Level 2, at which the pilot has to demonstrate that he has the appropriate (required) knowledge, understands mutual relationships between all factors affecting the tasks within the mission, and is able to perform operator's actions in accordance with the accepted standard for a given element of the task. In any instance of safety breach the trainee will receive a "dangerous" rating, which means that he will fail the mission regardless of any partial results obtained.

The adoption of the minimum (required) rating level at the end of a training module comprising of several flights determines the pilot's assumed susceptibility to training actions (number of repetitions necessary to master operator actions).

Effective flight training requires a number of activities aimed at identifying an objective possible to achieve and the most optimal way to achieve it. Tactical mission is the most complex and demanding flight mission. Periodic inspection and the implementation of ongoing mission execution evaluation are the factors due to which training standards can be maintained.

REFERENCES

- [1] Bondaruk A., *“Kształtowanie świadomości sytuacyjnej pilotów na przykładzie praktycznego szkolenia IFR z zastosowaniem symulatora klasy BITD”*, Taktyka i dowodzenie w lotnictwie wojskowym, WSOSP Dęblin 2015;
- [2] Air Force Instruction 11-202, Vol. 2, *“Aircrew Standardization/Evaluation Program”*, 13 September 2010;
- [3] Air Force Instruction 11-2F-16, Vol. 2, *“F-16 Aircrew Evaluation Criteria”*, 10 December 2009;
- [4] Rash Clarence E., Adam Gina E., LeDuc Patricia A., Francis G. *“Pilot Attitudes on Glass and Traditional Cockpits in the U.S. Army’s AH-64 Apache helicopter”*, , Presented at the American Helicopter Society 59th Annual Forum, Phoenix, AZ, V. 2003;
- [5] Institute of Air Navigation Services *“Lesson Delivery Basics”*, Luxemburg 2013;
- [6] Endsley M., *“Toward a theory of situation awareness in dynamic systems”*, Human Factors 37. 1995.
- [7] Kozuba J., *„Selected aspects of forming pilot situational awareness”*, PAFA, Deblin 2013.