

## A Study on Situational Awareness in Flight Training for Flight Students

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**Abstract:** Good situational awareness is the prerequisite for crew resource management and is crucial to ensuring flight safety. In this paper, we study the changes of situational awareness for flight students from pre-flight training to the training session, and then to instrument and commercial, analyze various factors that affect the formation of situational awareness of flight students, including trainers, their own conditions, flight training environment and other factors. Finally, it puts forward suggestions to a good situational awareness for flight students. The research in this paper plays an important role in the formation of a superior situational awareness for flight students.

**Keywords:** Situational awareness, Crew Resources Management, Flight training, Flight safety, Flight students

**INTRODUCTION**

Situational awareness refers to the cognition of various factors and conditions that affecting the aircraft and crew for the pilot or crew in a particular period of time and specific situations [1]. Situational awareness is a set of scenarios including pilot, aircraft, flight environment and operations. It is the premise of crew resource management [2]. Situational awareness will directly affect the flight safety. The stronger the situational awareness, the stronger the pilots' awareness of the above four aspects.

Therefore, good situational awareness is crucial to ensure flight safety. At present, most of the training on situational awareness is about mature pilots, with less training for flight students. However, situational awareness can have an impact on flight safety during the initial stages of flight training and will continue to affect the pilot's future flight operations. Therefore, if the pilots want to get a good situational awareness, they need training from the flight training stage [3]. So that by the end of the flight training, the pilot can has a

mature, good situational awareness and a better flight safety.

**Change and development of situational awareness during flight training**

Situational awareness of flight students in the flight training stage shows an overall upward trend, and the promotion speed in different stages is different, as shown in figure 1.

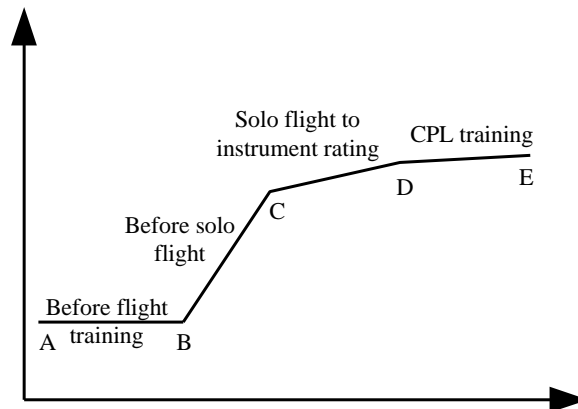


Fig-1: Curves of situational awareness of flight students during flight training

### **Situational Awareness of Flight Students before Flight Training**

Flight students may have a certain level of situational awareness before flight training, but at a lower level [4], as shown in figure 1 A to B. Before flight training, the aviation theory knowledge that the flight students learn mainly comes from the ground teaching. Because of pure theoretical knowledge, it is difficult to form a clear and systematic understanding, so it has little effect on improving situational awareness. At the same time, before the flight training, the flying students are not aware of the various conditions of the flight training, including the training environment, the distribution of instructors and the training mode, which will cause the flight students not to be confident, which will have a negative effect on the enhancement of situational awareness. Due to the longing for flight training, flight students tend to be in a state of excitement, resulting in less focus on things and a renewed fall in situational awareness.

### **Situational Awareness Changes From Initial Training to Solo Flight**

Flight training is the beginning of a pilot's real flight career and the beginning of the development of situational awareness. This stage is the initial stage of the growth of students' situational awareness and also the stage of rapid increase of situational awareness, as shown in figure 1 B to C. At the beginning of flight training, the learning efficiency of flight students will be high, and the situational awareness will also be very fast. Judgment of the weather conditions, familiarity with the aircraft, knowledge of the flight environment, communication with instructors, flight operations, observation of air traffic conditions and radiotelephony communication are very important factors for flight. Before first solo, the flight students should all have a good mastery, and these factors are the important conditions that affect the situational awareness. When a flight student can be able to solo flight, in addition to controlling the flight, the situational awareness of the flight students will also be a good level. At the same time, flight students will control the entire flight process on solo flight, which is a good opportunity for situational awareness training. When occur an unexpected incident in solo, if the students can handle it well, it will also be able to effectively enhance the situational awareness of them.

### **Situational Awareness Changes From Solo Flight to Obtain Private Pilot License (PPL) and Instrument Rating**

After solo flight, the status of flight students during flight training has greatly improved. During the stage of solo flight to acquiring PPL and instrument rating, the situational awareness of flight students will be slowed down, as shown in figure 1 C to D. At this stage, flight students are mainly to consolidate their knowledge, at the same time, conduct instrument flight training to improve the steady control of the attitude and

speed of aircraft, therefore, this stage is the process of consolidation and improvement of situational awareness.

The training at this stage is the transformation process from a flight student to a true pilot that can adapt to all kinds of weather. Changes of situational awareness at this stage will directly affect the pilot's future development and progress. Flight students should strengthen learning and training at this stage, enhance their skills and enhance the level of situational awareness as much as possible.

### **Situational Awareness Changes From Beginning of Commercial Pilot License (CPL) Training to The End**

Flight training at this stage is mainly to consolidate the existing skills, while learning the operation of dual-engine aircraft and flight mode to be a crew member. This stage is divided into time accumulation, dual-engine aircraft flight training and high performance flight training. This stage is mainly to train the coordination capacity of units, situational awareness will still slowly improve, as shown in figure 1 D to E. Coordination among units is a very important factor that affects the flight quality. Because the situation awareness at this time is very close to the future flight of airline, it should make good use of the training time, and make every effort to improve the situational awareness to prepare for future airline flight.

Different stages of flight training have different emphasis on the improvement of situational awareness. Therefore, flight trainees should train their own situational awareness with a focus on different flight training stage.

### **The instructor's influence on the situational awareness of flight students Instructor's Role in Training Students' Situational Awareness**

During the flight training, the instructors are the most frequent and most influential people for flight students [5]. Almost all of the knowledge and skills acquired by pilots during the training are come from their own instructors, especially in terms of aircraft operation techniques, the method of radiotelephony communication, the handling of air traffic situations and the handling of emergencies. They are very similar or even identical to their own instructors; therefore the teaching methods of instructors, the relationship between instructors and pilots and the replacement of instructors will have a direct impact on the training of flight students. It can be said that the instructor is the guide for flight student in flight training, the situational awareness of the flight attendant will be directly influenced by the instructor.

### **Impact of Instructor's Teaching Method**

Flight trainees will encounter different trainers in flight training, and different trainers' teaching methods will inevitably have differences. This will lead to differences that flight trainees receive during training therefore their situational awareness must exist a difference.

Instructor's attitude is one of the important factors that affect the training of situational awareness for flight students. Different instructors are different in treating teaching attitude and teaching methods, so the level of situational awareness is also different. Students who are taught by serious and responsible teachers usually have relatively complete theoretical knowledge and relatively sophisticated flight skills. They have a clearer understanding of all aspects of flying, more reasonable handling of various situations, and a better situational awareness. On the contrary, the situational awareness of the flight student will be lower. The degree of allowance for flight students of instructors is also an important factor that affects the level of situational awareness, especially the speed of ascension of situational awareness level. Appropriate allowance can make the flight trainees grasp the flight technology in a very short period of time. The level of situational awareness will be quickly raised to the appropriate level.

### **Impact of the Relationship between Flight Students and Instructors**

During the flight training, the relationship between trainees and instructors is another important factor that affects the development of student situational awareness. The relationship between trainees and instructors will not only directly affect the mentality of instructors in teaching, but also affect the learning attitude of students, resulting in the efficiency of both teaching and learning cannot reach a high level.

In the flight training, if the relationship between the trainees and instructors is relatively harmonious, both of them will be in a relatively relaxed state during the teaching process, flight training efficiency will be greatly improved, and the situational awareness will also be promoted rapidly. On the contrary, if the relationship between trainees and instructors is poor, the flight training efficiency of trainees will be reduced, which will not only affect situational awareness but also lead to the suspension and elimination of flight trainees in serious cases.

### **Impact of Instructor Changes on Flight Student Situational Awareness**

In the flight training process, the replacement of instructors is an inevitable phenomenon. There are many cases of instructor's replacement, replacement of instructors for no reason, failure of instructors for attendance replaced by other instructors on behalf of the class, or inspection by the prosecutor all belong to the

replacement of instructors. Because of the teaching level, teaching methods and flight habits are different for different instructors, when the flight trainees encounter new instructors; their situational awareness must be affected to some extent, and under normal circumstances are negative. On the one hand, the trainees have adapted to the teaching methods of the trainers. After the trainers are replaced, the trainees need a long time to adapt. On the other hand, changing trainers will result in psychological stress on the flight trainees, which will reduce the flight training effect.

In particular, after the trainee replaced, the trainee's situational awareness level was reduced to a lower level during the period when the trainees and instructors were able to adapt to each other. However, because different instructors have their own unique advantages, the situational awareness of trainees will be restored and greatly improved after the trainees and instructors adapt to each other. In the long run, the replacement of instructors will have a positive effect on the training of students' situational awareness.

### **The impact of flight student's own situation on situational awareness**

#### **The Importance of Cultivating the Situational Awareness of Trainees' Own Situation**

The trainees' own situation is the only factor that one pilot can adjust and control, but also the center of flight safety, all work is carried out around the flight trainees. All of the trainers, airplanes, airports, and so on, all boil down to the core factor of flight trainees, and the formation of a good situational awareness has no specific equipment or system, mainly due to its own efforts, so the importance of flying trainees themselves is obvious.

#### **Impact of Attitude on Situational Awareness**

The attitude of flight trainees to flight training determines their seriousness and learning efficiency in flight training, thus affecting their acceptance of all aspects of knowledge and skills, and thus affecting the training of their own situational awareness.

#### **Impact of Their Own Physical Condition on Situational Awareness**

Flight students in the flight activities will be unavoidable physical problems, the pilot is not a machine, physical discomfort is the inevitable problems [6]. The physical condition of the flight students is not only a simple state of health or disease, but also includes the ability of the body to adapt to the flight, the mental state, and the mood state in flight training. Physical condition will directly affect the training of the state, thus affecting the efficiency of learning, therefore, it has a significant impact on the level of situational awareness.

### **Influence of Aviation Knowledge on Situational Awareness**

Pilots not only need to master the skills of aircraft control, but also have to master a lot of theoretical knowledge in order to better manage the flight, deal with unexpected situations and ensure flight safety and quality [7]. Aviation regulations, weather, piloting methods, the understanding of the aircraft, the whole arrangement of the current flight, etc. In the process of flight training, flight trainees must have a solid theoretical knowledge to fully prepare for the flight, manage the flights more reasonably during the flight so as to accomplish the training tasks better, and when the training is completed better, The higher the level of situational awareness.

### **Impact of Communication Collaboration Ability on Situational Awareness**

During the flight, pilots do not complete their own tasks independently. They need to exchange and collaborate with each other harmoniously to maintain the crew's overall situational awareness so as to ensure flight safety and quality. During the flight training, flight trainees will form a crew with the trainers to control the whole flight. The exchange and cooperation between trainees and trainers will directly affect the flight crew's working efficiency and thus affect flight quality. When the communication between flight trainees and trainers is in a harmonious state, trainees will understand instruction and explanations of trainers more clearly, and trainees will also be able to understand the trainees' ideas and present conditions better. As both of them, will reach a relatively high situational awareness level, training tasks will be better completed, but if trainees and trainers cannot communicate directly and collaborate, the trainee is difficult to understand the trainer's explanation or instructions given in a short time, the instructors also failed to understand the students' thoughts and conditions in time. The level of situational awareness of the crew was low, the flight training efficiency was low, and the training task was not completed well.

### **Impact of Flight Training Environment on Situational Awareness**

The pilot's flight environment is an important factor affecting his situational awareness. The environment that affects situational awareness for flight students is the flight training environment, including the number and quality of instructors, the number and performance of aircraft and simulators, the airport used, the schools located, the environmental and climatic conditions in their area, all of the above are part of the flight training environment

The quantity and quality of instructors are an important manifestation of the quality of aviation school operation. The completion of training tasks for flight trainees and the cultivation of situational awareness during flight training are all linked with the training.

Only when the quantity and quality of instructors are guaranteed, flight students can learn the correct theory and practice training, the acquired knowledge and skills can achieve the expected goal, and the level of situational awareness can get a higher level.

The number and performance of aircraft and simulators owned by an aviation school and the conditions of the airport are all part of the training hardware. These are all facilities that flight students need to use directly during flight training. If these facilities cannot meet the requirements of flight training, the flight training will not be completed as required, flight trainees will not be able to acquire sufficient knowledge and skills, and situational awareness will hardly reach the ideal level. Only when the hardware facilities meet the requirements will the situation awareness reaches a higher level.

The geographical environment and climatic conditions in the area where the aviation school located will directly affect the ability of the flight trainees to adapt to the environment in flight training, if flight training carry out in the regions with relatively complicated geography and relatively harsh climatic conditions, the flight trainees will receive more rigorous training and testing, the ability to adapt to the environment is relatively high, the level of situational awareness is relatively high and great potential for improvement.

### **Measures to improve the level of situational awareness of flight students**

In order to make the situational awareness reach a certain level, flight trainees need to take certain measures to enhance their situational awareness during flight training.

First, pilots should have a sense of situational awareness during their flight training and should avoid training that focuses on individual flight skills. During flight training, pay more attention to the mistakes made, sum up the rules and experience before the flight preparation, implementation of flight and post-flight assessment, and strive to maintain a high situational awareness level.

Second, master the relevant theoretical knowledge before actual flight training, master all the possible situations encountered in the flight and the measures it should take so as not to undermine the scope of regulation or flight control and bring him into unforeseen circumstances during the actual flight, and make reasonable operation in the event of a sudden situation. Good flight training is the prerequisite for situational awareness.

Third, keep an appropriate state of tension and vigilance on the flying during the flight, keeping an eye on the environment in which the aircraft is currently

located and the environment it will be entered next. Flight students should make their thoughts in front of the plane, so as to make timely and reasonable decisions and actions. This situation will make the flight student easier to manage the entire flight, and then further improve the quality of flight. The situational awareness of flight students can achieve and maintain a high level.

Fourth, make full use of the simulator to train the situational awareness in complex environment. The simulator can make the flight trainees train the infrequently encountered situations without any real danger to the personnel and the aircraft. So that the flight trainees can master the reasonable treatment of these situations. In this way, trainees can make correct decisions and actions when they really encounter these situations. Repeated training on the simulator can make flight trainees accurately and quickly deal with the problems when they encounter, and their situational awareness level will be compared high status.

Fifth, adjusting their own status is an important guarantee for maintaining a high level of situational awareness. Maintaining a positive attitude and a healthy state of mind and body will enable the flight students to maintain a good working condition, achieve and maintain a high level of their ability to recognize and judge the surroundings, and be better able to grasp the entire flight during the flight situational and status, have a higher adaptability to the flight environment, and have a high level of situational awareness.

## **CONCLUSION**

With the development of aviation technology, the influence of human factors on aviation safety is becoming more and more important. Therefore, the importance of situational awareness to flight safety is becoming more and more obvious. The level of situational awareness has become an important basis for judging the quality of a pilot. The flight trainee's task during the flight training is not simply to acquire certain flight skills. The training of situational awareness is also a very important part of the flight training mission. The flight students should recognize the importance of situational awareness training and understand the various factors that affect situational awareness and continuously improve their situational awareness during flight training so as to lay a good foundation for the future flight.

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