

# How to Reduce "Error, Forget, Leak" in ATC Work

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## Abstract

In recent years, the air traffic control system at all levels for the "errors and omissions" problem almost every year to carry out special rectification, its ideas can not be ignored. Its strength is not small, but the problem has not been fundamentally solved, and has become a stubborn disease affecting the safety of control. The cause of "forgetting mistakes" is more general and vague, and the countermeasures adopted are not precise and systematic enough. From the angle of human factors and objective factors, this paper thoroughly analyses the potential safety hazards of human factors in China's air traffic control work, and comprehensively considers the factors such as hardware and software equipment, physiological and psychological characteristics of human beings, and analyses in detail the contributing factors of human errors of air traffic controllers. At the same time, combining with the actual work of air traffic control, it puts forward the hope that China's air traffic control work will become more and more scientific.

## Keywords

Air Traffic Control (ATM), Air Traffic Controller (ATCO), Human Error (HE), "Error, Forget, Leak"

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## 1. Introduction

People are constantly improving the safety of civil aviation with new technologies. The technical factors causing early flight accidents as high as 80% have gradually decreased to 20%, while the human factors have increased from 20% to 80%. Human factors will be the key factors affecting the safety of civil aviation in a long period of time. Therefore, to solve human factors and prevent human error HE (Human Error) will become an important way to further reduce the rate of flight accidents and improve the level of flight safety.

With the rapid development of civil aviation industry, the number of flights has increased dramatically, and the pressure of controllers has also increased. In order to reduce or eliminate the occurrence of unsafe incidents caused by control errors, forgetfulness and leakage and ensure flight safety, it is necessary to study the phenomenon of "errors, forgetfulness and leakage" in control work. Current ATC safety work has several prominent characteristics: first, the overall security situation is stable, but some time fluctuations are large; second, there are many human errors, "errors, forgetfulness, leakage" is particularly prominent; third, the external environment is still restricting ATC safety. In today's air traffic control system, with the progress of science and technology, the reliability of machinery has been significantly improved. Human factors are the weakest link in the system. Therefore, effective measures must be taken to reduce human errors and their impact.

## **2. Analysis of Controller's "Error, Forget, Leak" from the Perspective of Human Factors**

### **2.1 Controller's Attention Diversion or Misallocation**

Attention transfer is mainly the incorrect choice of the content or timing of the new object of attention. Controllers often have to deal with multiple information and deploy multiple conflicts at the same time. For example, when dealing with multiple air flight conflicts, the controllers must focus on one of the conflict points. If the controllers only pay attention to one of the conflict points, the improper transfer or allocation of attention will inevitably lead to the forgetting of other flight dynamics.

### **2.2 Controller's Short-term Memory Impairment**

Air traffic control service information is mainly expressed by flight number, flight altitude, location, time and other factors, and the information coding of these elements is sometimes not obvious (such as flight number is only one number or one letter), so these information is easy to be confused in artificial memory. Because of the characteristics of air traffic control service information, air traffic controllers are required to memorize a large amount of information in a relatively short time when processing information, which is a great challenge for controllers.

### **2.3 Controller's Bad Working Mood**

Bad working mood not only affects the quality of work of the controllers themselves, but also causes emotional contagion within the team, resulting in tension in interpersonal relationships, destroying the working atmosphere of team cooperation, resulting in poor communication and coordination within the team.

### **2.4 Controller's Thinking**

We should not only oppose dogmatic thinking, but also avoid making mistakes in empirical thinking. Experience is a double-edged sword for control work: experienced controllers can easily make decisions on conventional flight conflicts; if the environment changes (such as when the original experience is no longer applicable), controllers can still cope with the old mode of operation, which may lead to human errors.

### **2.5 Controller's Fatigue**

Fatigue is an important part of job research, so it is also the main research content of human factors. The hazards of fatigue are recessive. Our management often classifies the control errors caused by fatigue as weak control responsibility or low control ability, which is unreasonable and does not play a positive role in the study of human factors. The repeated occurrence of unsafe incidents tells us that fatigue is a problem that can not be ignored, so we must face up to the role of fatigue in the factors of air traffic controllers.

## **3. Depth Analysis of Controller's Mistakes and Omissions from Objective Factors**

### **3.1 Working Environment**

Working environment such as air quality, illumination, noise and so on will also affect the quality of the controller's work. We know that people working in turbid air, strong light, high temperature, noise and other environments will consume a lot of energy and physical strength of the staff on duty, thus accelerating the fatigue of the controllers, eventually leading to the controllers' mental depression, memory decline and inattention. Studies have shown that people's judgment, analytical power and emotional control will be reduced to a considerable extent in a poor environment for a long time. Due to the insufficiency of research on the impact of air traffic control system on environmental factors and the quality of work of controllers, the working environment is still a neglected factor.

### 3.2 The Regulatory Environment

When the regulatory environment changes dramatically or unexpectedly, it is possible to change the attentions of controllers, the allocation of regulatory energy, the ability to resist psychological pressure, and the coordination between them.

Controller's work intensity and load: Low-load workload will make controllers feel dull, monotonous, distracted, and even chat with each other between seats, which reduces the alertness and reduces the ability to monitor the dynamics. Similarly, too much work intensity or even exceeding the human limit will reduce the efficiency of information processing, thus affecting the actual operation level and execution ability.

### 3.3 Complex Meteorological Conditions

Complex meteorological conditions are also an important factor causing controllers' human errors. Complex meteorological conditions mainly include poor visibility, thunderstorms, hail and cumulonimbus, aircraft icing, turbulence and jet, and low-altitude wind shear. For example, low cloud and low visibility conditions are not conducive to the visual inspection of flight dynamics by controllers, which may cause the controllers' ambiguity of "situational awareness" and lead to the problem of human errors by dynamic controllers. In thunderstorm weather, pilots need to inform the controllers of their intentions to circumvent the thunderstorm, which is slightly congested with air traffic control communication waves.

The road seems more crowded, invisibly increasing the workload of controllers. Because of the influence of thunderstorm, the aircraft flying on their respective routes may fly in the same area because of the need to circumvent the thunderstorm, which may result in the same altitude aircraft flying in the same area, greatly increasing the probability of controllers making artificial errors.

## 4. Conclusion

The phenomenon of "forgetting and omission" seems to be an isolated problem occasionally appearing in the daily control work. In fact, there are many hidden failure links behind it, such as the construction and management of grass-roots units, the planning and culture of units, etc. We must pay full attention to the principle of the occurrence of "forgetting and omission" and summarize the occurrence law of "forgetting and omission". With the increasingly complete system and the increasing influence of controllers on ATC safety, if the importance of human errors in ATC is not fully understood and the concept of human factors in ATC safety management is relatively vague, it is easy to ignore the defects of human behavior and its impact on ATC safety, and the advanced research results of human factors can not be introduced in time. So far, due to the lack of independent research, the effect of solving specific problems in the field of air traffic control is not ideal.

From the current research situation, although great breakthroughs have been made in the field of human error management of air traffic controllers abroad, there is still a lack of adaptive practice in introducing specific projects into China. At the same time, the current domestic research on human error of air traffic controllers is basically through case studies. With China's air traffic control system and international air traffic controllers, especially in developed countries such as Europe, America and Japan, etc. With the continuous exchange and cooperation, more and more attention will be paid to the study of human error of air traffic controllers in China, and the work of air traffic control in China will become more and more scientific.

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