

UDC 629.7.07

<sup>1</sup>Volodymyr Kharchenko, Prof.  
<sup>2</sup>Yuriy Chynchenko, assoc. Prof.  
<sup>3</sup>Stefan Raychev

## REGIONAL APPLICATION OF THE FIRST EUROPEAN AIR TRAFFIC CONTROLLER SELECTION TEST IN BULGARIA

NAU Air Navigation Systems Department

<sup>1</sup>E-mail: kharch@nau.edu.ua

<sup>2</sup>E-mail: jdestiny@ukr.net

<sup>2</sup>E-mail: raychevstefan@abv.bg

*Understanding Human Error in Air Traffic Control – the nature of human error was explored and the different types of error were clarified. The modelling of human error was explained and the most comprehensive approach within the Air Traffic Management system was described.*

*Розглянуто питання, пов'язані з розумінням причин помилок людини-оператора в системі організації повітряного руху і різні види помилок. Описано моделювання помилок людини-оператора з урахуванням всіх вагомих факторів у системі організації повітряного руху.*

### Introduction

Planning and decision-making are two almost inseparable tasks which are central to the work of an air traffic controller. On the one hand, there is the strategic planning of airspace carried out by the management to ensure the safe and expeditious flow of traffic into, out of and through their area of responsibility, together with the provision of suitable and sufficient equipment and personnel to control the traffic.

On the other hand there is the tactical planning and decision-making carried out within a sector by the supervisor and the controllers and their teams, to deal with individual flights passing through the sector.

Analysis of incidents involving human error carried out within Europe suggests that between 50% and 70% of incidents involve the planning and decision-making process, principally resulting from incorrect decision.

It is therefore important that high priority should be given to these functions by investigating incidents and analysing errors, and by working with the Air Traffic Control (ATC) teams to reduce the likelihood of recurrence.

As with all such functions, all parties involved must be encouraged to participate fully so that the analysis is comprehensive and the right lessons are learned. This implies the existence of a strong safety culture embracing a just reporting policy.

### Decision-making in Air Traffic Control

Almost all decisions made in ATC can be classified as Tactical or Strategic. Tactical decisions are those decisions related to the directing of the actual traffic. They deal with decisions made within strict time and procedural constraints.

However many of these decisions still have several possible and safe alternatives; the number of which increases as your experience grows.

Examples are:

- selection of a conflict resolution strategy;
- change of FL, heading, speed (clearances);
- using emergency phraseology;
- passing information to colleagues;
- dealing with information received from colleagues or pilots.

Strategic decisions are typically made by those in ATC given the specific role to do so. The planner, supervisor, or traffic flow manager, although all personnel have the opportunity to do this type of decision making, depending on the situation.

For instance at a handover when the controller takes responsibility for the planning of the traffic already accepted by the previous controller.

Examples are:

- monitoring colleagues and trainees;
- leaving position;
- briefing;
- asking for assistance;
- accepting traffic load;
- triggering an emergency plan;
- sector staffing and splitting.

Decision making assumes that an individual has the ability to derive and evaluate relevant information about a situation and the knowledge and confidence to select and implement an appropriate and timely action.

Decision making can be considered a series of rational mental steps and refers to the ability of an air traffic controller to do the following:

- detect situation – this assumes that the controller has searched and found the relevant information;
- recognise situation – this assumes that the controller has the necessary background knowledge to be able to recognise a problem and can discriminate it as such;
- diagnose situations – this assumes the controller has the necessary background knowledge to be able to compare from memory the present problem with others they have encountered;

– determine available alternatives – again this assumes the controller has not only the necessary background knowledge to be able to compare from memory the present problem with others, but also that their experience allows them to choose the best available alternative which they may have encountered before;

– determine the risk with each alternative and choose one – once the controller has a solution, they must assess whether this particular solution will work, this again relies on specialist knowledge and experience.

Act and check the result – the last step in the decision making process is to act on the decision made and then check to see if it in fact was the correct solution. It is at this point that a new solution can be chosen if there is time.

It is well known that the decisions made in this environment are usually made in a multi-task setting, and also in a multi-demand setting. This is quite an unusual combination and as a result ATC personnel are often referred to as expert decision makers.

### The Nature of Human Error

Error can be considered in its most basic form as those intended actions which are not correctly executed. At a simple, but often opaque level, errors are actions which suffer from various unconscious or conscious mistakes and finally, at the most transparent level, errors can be considered any activity which results in an incident or accident that may involve personal injury / death, and/or property damage.

Studies show that human error rates during the performance of simple repetitive tasks can normally be expected to occur about once in 100, and an error rate of 1 in 1000 is regarded as good. It has also been demonstrated that under certain circumstances human reliability can improve by several orders of magnitude. As long ago as 1940 it was calculated that about 70–80% of aircraft accidents could be attributed to the performance of humans and this figure remains very consistent.

This situation is not unique in aviation and it has been estimated that 80–95% of accidents in other professions such as rail, sea and road transport, nuclear power plants and medicine, are also the result of human error. The following graph, from Boeing, indicates the numbers of air accidents in the last forty five years and predicts these events in the next five years (see figure).

It can be seen from the graph above, that if things remain the same but air traffic increases, there will be a subsequent increase in the numbers of accidents and incidents as a result.

However the most recent occurrence data has indicated that the accident rate seems to be flattening off at the moment. Unfortunately the nature of accidents indicate they follow a chaotic and complex path and can never be fully predicted.

Studies have recently indicated that controllers make approximately three errors an hour, although it has also been shown that controllers are very good at recovering and managing many types of errors. Several studies have indicated that most air traffic control errors occur in the following situations:

– 70–74% of errors occur under light to moderate traffic conditions and complexity;

– 45% of errors occur during a controllers first 15 min on position;

– 62% of errors occur when controllers have had less than six years experience.

Human errors also vary widely depending on the task and the context in which the Air Traffic Management (ATM) personnel are working. Examples of some of the common causal factors associated with incidents are as follows:

– fatigue as a result of high workload;

– sleep loss and quality;

– lack of skill from consistent practice;

– misunderstanding during communication;

– lack of information which is not shared with others;

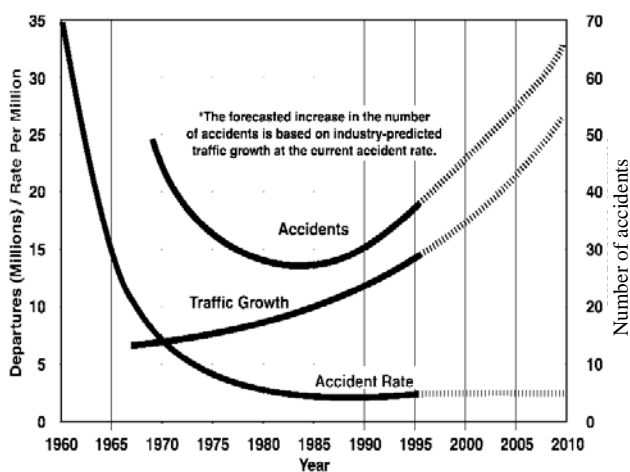
– complexity of traffic and airspace;

– assumptions which are not questioned;

– failing to follow a procedure or rule.

Research within the ATM system in Europe has highlighted the aspect of decision making as the most error prone cognitive issue, although the area of perception and vigilance seems to be related to the most risky and severe incidents.

Traffic and airspace as well as issues of teamwork activity have also been highlighted as the most common factors which are associated with incidents.



Hull loss accidents

## Sources of Error in Air Traffic Control

The information processing models demonstrate the importance of the cognitive factors in the control process and emphasise that many problems occur at the input stage to the human system and also in the subsequent selection of the appropriate programme or procedure to respond to what was perceived. In order to explore this in a little more detail let us summarise some of the specific problems.

The main problems can be found in the perception, memory, decision making and action response phases of information processing.

These information processing stages will now be considered.

Information is organised into meaningful data but can, however, suffer from various problems in the perception stage of processing.

Some examples are given below:

**Illusion:**

- the mirage effect that can be seen from the tower in hot or humid weather that distorts the position of taxiing aircraft;
- the effect found at night when aircraft appear closer than they are.

**Inadequate or ambiguous information:** at a change of shift you are told there are number of aircraft lined up waiting for take-off clearances, with two in front, two in the middle and two in the rear – is that a total of six or four?

**Assumption:** when you give a conditional clearance you assume, although the pilot did not give a complete read-back that they have understood your instruction.

These issues are associated with both long-term and short-term memory. Some examples would be:

- forgetting a rule: this is a problem associated with information that is not used very often and has not been practiced and can be seen in the incomplete use of 'avoiding action' phraseology;
- experience and habit: this is the problem of reverting back to old responses, particularly under stress;
- misjudging a conflict point: this includes not taking into consideration all the contextual details such as aircraft performance and strength of the wind.

Decision making can be degraded in various situations. Some of these are listed below:

- inadequacy or recency of training;
- commercial pressure of the company;
- fatigue;
- motivation.

In order to prevent and/or mitigate problems with judgement, planning and decision making, some general issues need to be considered.

These issues are found in the circumstances in which the controllers do their job (see table).

**Psychological factors:**

- high expectancy;
- diverted Attention;
- performance following high concentration;
- motor memory.

## Application of the First European Air Traffic Controller Selection Test Package in Bulgaria

The FEAST Service provides a selection tool for the selection of Air Traffic Control Officer candidates [1]. The tool is customisable to meet the varied recruitment requirements for ab initio applicants by Air Navigation Service Providers (ANSPs) throughout the European Civil Aviation Conference area and intensively used in Bulgaria.

FEAST is a professional state-of-the-art web-based testing tool which improves the quality of selection decision making by ATC recruiters.

The tool is provided as part of the FEAST Service which also includes the technical means of delivery to User ANSPs, full implementation support, a helpdesk service to Users, and participation in FEAST User Group activities and benefits.

The FEAST service is in use in 12 European ANSPs (including Bulgaria) and this number is expected to increase in 2006.

The main FEAST service activities focus on the provision of:

- user support in the planning, customisation and implementation of FEAST (consultation, co-ordination and technical advice, user and administrator training);
- a centralised infrastructure and service resources to provide customer support and maintenance of the selection tool infrastructure at EUROCONTROL (on-going technical support of the FEAST platform and the FEAST database);
- user driven evolution and development of the product and service (technical and application improvements and changes, maintenance and validation activities, development and integration of new tests).

The aim is to make an easily administered package of scientifically sound selection tests available for multi-state use for use in the recruitment of ab initio trainee controllers.

The selection tools assess the knowledge, skills, abilities and other characteristics of applicants which are relevant to the training and job of controller and therefore critical to the selection decision.

**Specific recommendations to prevent and/or mitigate problems  
with judgement, planning and decision making at ATC**

What goes wrong	Error specific recommendations for mitigation
Misjudge aircraft projection	Check the reliability and quality of displayed information. Check controller's ability to process spatial information. Check controller's knowledge of aircraft performance. Check the controller's use of and skill in available system support (extrapolation vectors, trajectory display, range setting etc.) Re-train if necessary
Misjudge severity of potential traffic conflict	Check workload. Check controller's stress management strategies. Help controllers to develop and/or optimise stress management strategies. Check controller's possible perception problems.
Incorrect decision or plan	Check workload. Check the controller's knowledge of decision making processes. Check controller's decision making strategies. Help controllers to develop decision making strategies. Check controller's competency. Re-train if necessary.
Late decision or plan	Check workload. Check the controller's knowledge of decision making processes. Check controller's decision making strategies. Help controllers to develop decision making strategies. Check controller's ability to prioritise. Check controller's competency. Re-train if necessary
No decision or plan	Check workload. Check the controller's knowledge of decision making processes. Check controller's decision making strategies. Help controllers to develop decision making strategies. Check controller's ability to prioritise. Check controller's stress management strategies. Help controllers to develop and/or optimise stress management strategies. Check controller's competency. Re-train if necessary

Usage of the FEAST in Bulgaria has resulted in a number of strategic and operating benefits:

- state-of-the-art testing option built in conformity with EUROCONTROL Selection Guidelines and offering the possibility of future test updates. FEAST therefore meets and sets high standards for Quality Assurance in the test materials, test delivery and standards of test administration and application;
- a flexible and cost effective tool giving more informed predictive information about the most suitable candidates and so improving training success rates;
- a common platform for use throughout Europe enabling economies of scale and synergies in test administration, standards and application plus the possibility of shared future developments;
- FEAST is a harmonised selection tool, which will enable more commonly recognised controller profiles and entry requirements thus easing the way in which future European mobility of labour policies are met.

### Conclusions

The opportunity for error can also be considered in terms of the stage the error occurs in the information processing sequence. The sequence includes the Detection, Diagnosis, Decision and Execution of an event. The opportunity for errors to arise at any stage of the sequence, reflects the basic activity of a controller in any complex dynamic system. It has been found that in ATM, as with other similar control systems, that if controllers fail to detect a situation through a perceptual error, it is impossible to recognise and recovery from this sequence. It is for this reason that machine alerts and colleague warnings are extremely important in supporting the management of these errors. All other error categories (memory, decision making and action) are more likely to be detected, diagnosed and recovered as long as the controller has the knowledge, information and time to act.

### References

1. <http://www.eurocontrol.int/humanfactors/gallery/content/public/docs/BROCHURES/feast.pdf>

The editors received the article on 9 October 2006.