SOFTWARE ENVIRONMENT FOR PROCEDURAL TRAINING OF AIR TRAFFIC CONTROLLERS

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This article deals with procedural air traffic control. Furthermore, the article discusses the history of air traffic control, the air traffic controller training and procedural management functionality provided by the software for training procedural control LProcedural.

K e y w o r d s: procedural control, radar control, air traffic controller, flight progress strip, tower, software environment

1 INTRODUCTION

The current period of "fast" life depends on overcoming various distances whether passenger or freight air traffic. Its success depends on speed, safety, economy and comfort. From these considerations, air traffic closest to the required criteria. The continuous development of new technologies, high-quality aircraft sophistication with modern information facilities, development and qualification requirements for pilots, managers, improvement and unification of international aviation practice ensures growth improving aviation safety, which is one of the important criteria for its use by prospective customers. Significant impact on aviation safety, among other things, the air traffic control service and the provision of air traffic. Technological progress and increasing complexity of systems and the demands not only on the flight crew, as well as air traffic controllers, who demands on time and the continuing growth of air transport are required to handle difficult air situations. According to statistics, 80% of ICAO aviation accidents are caused by human factors, of which almost 41% is due to procedural errors, more than 40% of the poor qualifications of the staff, nearly 10% as communication errors, more than 9% lack of knowledge, experience and skills.

2 AIR TRAFFIC CONTROL IN SLOVAKIA IN THE 60TH YEARS

Aviation in Slovakia before 1960 was only beginning and studying to do in Prague. Aviation, airports and everything was flying around in Czechoslovakia was strictly confidential. Those interested in flying had the opportunity to engage in civil aviation by flying clubs that belong to the Association for Cooperation with the Army (Svazarm). For flying pay system applicable in military aviation. After completing a three-month theory course to start to fly sport. For example flew on all-wood "Bikram" OK-BJG, officially called C-106. Stunts were used to-wood trainers type Z-26 officially called C-5.

Experts in aviation is a big shortage and so the "air traffic controller" in the 60-ies of the 20th century became a people without education - eg. former telegrapher. They have not asked such requirements as it is today, nor was such advanced technology as it is today.

From universities in Slovakia was to manage traffic closest Faculty Organization and air transport economics at the University of Transport in Žilina, focusing mainly on Soviet methods in aviation.

Training pilots and managers in Slovakia was carried out through training courses in Bratislava. The first course that began in 1966 at the airport Ivanka. This form of education, however, proved insufficient or time or professionally.

In the 60s of the 20th century the tower at the airport in Bratislava Ivanka in charge of the airport and its surrounding area within 30 km and up to 3000 m.

Air traffic is managed so that the hand-made graphic record of the movement of aircraft on squared paper about the size of 80 cm vertically and horizontally about 100 cm. It was divided vertically into two halves: the left was from day 0 hours in 1200, right night from 1200 to 2400. One half were divided vertically into 12 parts, each part was one hour, each square was 5 minutes. Horizontally, the read distance. Each square is 5km.

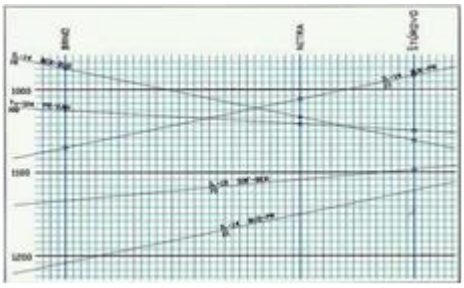

Fig. 1 Graphic record of the movement of aircraft

At that time it was quite savvy system. Experienced staff of air traffic management at a glance assess momentary air situation in the field, along with an expected flights at least an hour in advance.

The task of controller was expected to record a real time when aircraft crossing over compulsory reporting points and to allocate flight level, so as to prevent the possibility of convergence of two airplanes on the same level.

This scheme has been used until about 1965 when it was replaced so. flight strip system (flight progress strip). Information on the aircraft were written on strips of paper that are deposited in a time before descending on board air traffic controllers. Major landmarks were marked beacons called NDB (Non-Directional Beacon), or radio transmitters. A popular radio in Slovakia as they were. Great Kostoľany. They used a "computer in the head." - Flight control had to keep in mind the different knowledge from different

sources, and use them to make decisions and solve various conflicts. In addition to the connection with the aircraft pilot was tasked cooperate with neighboring departments: with airport towers in the area. In Slovakia, it was Bratislava, Piestany, Sliač, Poprad and Kosice and sometimes military or aeroclub airports, with the military air traffic and neighboring areas - Austria, Czech Republic, Hungary, Poland and the Soviet. Collaboration has been mainly in the form of exchange of information on flights expected, the changes in the plan and solve various problems associated with international air traffic.

Connect with neighboring departments were by telephone or by telex. Telex was solid, but it was slow. Phones were "lively" - sometimes reliable, sometimes not. Connection with aircraft tower had radiotelephone. Area with aircraft communicate exclusively through telegraphy. Telegrapher had its special office and reports from aircraft and aircraft written on pieces of paper, worn air traffic controllers. Besides receiving and transmission of messages should responsible for the submission of information on airports, weather reports, as well as surveying. They did it at the request of the aircraft. Telegrapher find geographic aerial shooting angle from which the signal comes through a plane with angles of two telegraph stations were able to determine your location. This, however, was present and telegraph communication between air control. At this time, most of the aircraft was flying speeds of about 300-450 km / h, namely 5-8 kilometres per minute. In five minutes, it was a 25 to 40 km. Already started to fly a jet aircraft, which flew for one minute, 15 km, and the connection of airports with towers has shed such a system makes sense, especially given the relatively small size of Slovakia.

The connection with aircraft were used radiotelephone stations operating on shortwave. These were not reliable because of frequent "dead" spaces, characteristic for short connections and also for relatively strong interference caused by different sources, eg. storms, sunspots, etc.. For these reasons, began to promote the transition from radio telegraphy. In addition, the Czech and Slovak also used Russian and English. These languages, however, few controlled. Around the year 1963, started using microphones.

The introduction of microphones caused a new problem. Radio transmitters and receivers, particularly their antennas on very high frequency (VHF) were placed in a Ivanka airport, in the very corner of Slovakia. The topography surrounding terrain and because of the curvature of the earth, the connection to the aircraft can only run about 50 to 150 km (the most common altitude and the direction) and to about 300 km and at altitudes above 5000 m. Slovakia is about 400 km long. Area responsible for the entire territory. For a variety of formal and practical needs should also have connection outside, at least up to a distance of 200 km from the border. VHF coverage was inadequate. Some aircraft have had a telegrapher on board and this lack was not as pronounced.

Areas worked on radar at wavelengths have similar characteristics as wavelength transmitters and receivers. The consequence was that the aircraft at low altitudes (between 1200 to 1800 m) were seen only within the 40 to 150 km .. Radar had a maximum range of 400 km, but as in the case of transmitters and receivers, the antenna was placed on Ivanka Airport, where mountainous terrain and earth curvature limiting its reach. Given these facts, as well as problems with communication between the aircraft and the ground, this radar is not used at all, although it was still available. The screen was seen mostly rain and storm clouds, ie those that were filled with water or ice. often been seen as a cold front approaching (usually from the west), shape, and pass over the territory of Slovakia. It was interesting how often the actual position and speed of the procedure differed from that provided weather forecasts.

Air traffic control service has available a variety of equipment, without which it cannot perform its function. Some were so high importance that failure of more than a few seconds to be harmful to aircraft safety. These were mainly radio transmitters and receivers. In the second category were the phones. Somewhat less important as they were. telex, radio beacons in Slovakia, etc.

In addition to insufficient coverage area transmitters and receivers were of poor quality, fault, broadcasting was often difficult to understand. Disorders, although not common, but the air traffic control sometimes a few seconds may endanger the safety of aircraft.

3 THE CURRENT FORM OF PROCEDURAL MANAGEMENT

Currently, the Slovak Republic belongs to the last of which are procedural training included in the licensing staff. Each air traffic controller, which controls any radar unit is well trained to manage without radar data. Managing the habitat to provide area control services (ACC) has two licenses. License PC which receives as the first and the license RC, which is obtained as follows after receiving PC. PC is a planning control, respectively. procedural RC controller and a radar control respectively. Radar Controller. The station, which provides an approach control service, this is like. Managing to be training for aerodrome control (TWR) and the habitat Approach (APP) and includes procedural training. Often the question arises whether it is even highly professional technicians who service air traffic around the world have, must rank as training wheels to radar. Based on the statistics, we can say that the chances of losing radar target is almost zero. Everything is secured advances and the chances of degradation of the radar are also minimal. Opinion on this issue is different in each direction. One side argues that technology will never be fused so as to allow the possibility of loss of radar target excluded. Another side argues that the possibility of loss of radar target are minimal and there is no further need to control procedural teaching. No training on radar refuse degradation. The last group could be classified people with the idea that technology forward and it always has

been so perfect that practically no chance to use radar control in live operation and therefore not practice this is not necessary. Which of these views are in the majority, the question remains uncharted. Everyone should ask yourself whether it is really impossible to extinguish monitor responder on board, failed ground radar, or other error occurred. The real question therefore is not an option if such a thing can happen, but whether we are sufficiently prepared to when something like this happens. In the Slovak airspace, in the case of having used standard procedures for radar control. They are generally written in ICAO Annex 4444, where they are given considerable attention. The radar control, we can talk whenever we have no specific information to any radar. This does not mean that we have no radar display. It may happen that a small aircraft in controlled airspace responder fails. Small aircraft under the Act need not be equipped with a second set of airborne, so it could be a problem. If it is not within reach or no primary radar, would have to accede to the management radar. Due to the specific aircraft as well as other aircraft had to be taken if they were radar controlled. This would mean that if the aircraft is not maintained responder flight altitude 6000 ft, and two planes over it would maintain 7000 ft may be the two radar is controlled. They must not be controlled radar is when crossing the conflict level, or horizontal distance the plane without responder. According to radio-navigation equipment and aircraft on the ground, based on the functionality of the devices and perhaps the size of the space in which it was lost to radar target, we have several options to resolve the situation.

4 TRAINING OF PROCEDURAL CONTROLLERS

Each air traffic controller in Slovakia started his practical training with procedural controll training. An exception is the habitat of airport control tower, which do not apply to procedures for approach control and area control center. Training Center ATS is located at the MR Stefanik in Bratislava. Fulfills its function mainly in the training of new air traffic controllers, as well as for maintaining licensing of older executives. The first part of the training is purely theoretical. This phase could be compared to a full-time studies at a university. Participants will learn a variety of subjects such as meteorology, regulations, human factors, procedures for air traffic services and so on. This whole part takes about 3-5 months. This is followed by examination of the theoretical part of the exam and to obtain ICAO Language level 4 or higher on the aviation authority of the Slovak Republic.

Also, the pilot must make the license radiotelephonist at telecommunications office. After you have completed this section, shall be treated for practical elements.

Training for TWR / APP begins in a tower simulator, which trains future managers Chief Instructor of the virtual airport in a virtual environment. The exercises gradually gaining strength in the amount of traffic or load, or quantity requirements. During the practical part, they control a variety of training, tests, theoretical teaching and the like. After control tower, are treated to procedural management station to APP. Again, it is a virtual industry, which in this case is used mainly to learning management and acquisition of appropriate habits for the use of particular techniques. Participants also watch live go directly to management stations. Following is called Midcheck - examination of management. This is roughly in the middle of training. If the trainee passes him, he is in phase OJT - On Job Training. It is a unit training. Here acquires supervised OJT instructor experience directly on the job for which it is intended. In addition to the training center to train in other situations to expand and maintain competence. After receiving training, the final check on a final exam. The final check, that is, in the words of management more difficult than final exam, a trainee to "light" a few instructors, Chief Instructor, leading change, and sometimes the Authority or the Director General of LPS. Final exam is similar to final check. Difference is that the check is to determine whether the graduate's level to deal with exam-u. Of course there is also a test of the theory. After the final examination by the Authority, the successful student licensed air traffic controller and the training is finally over.

The mere procedural control begins applying temporal spacing. Pupil finds from (pseudo) pilots estimated times which are at specific points. Then assess the situation and assigned times so that the FAPE, or at any other point to which it will apply spacing, spacing of at least 5 minutes. If the front is maintained right aircraft's air speed by 40 kt higher separation may be reduced to 3 minutes. However, this does not normally apply. The actual time separation is not always adequate. If we had a very slow and very fast airplane, so 5 minutes would not be sufficient in practice. The aircraft would be able to feel some time to fly over them, but the point of destination must reach already in 5 minute spacing. Therefore, the management usually coordinate entry into TMA already preklesanej level and gradually aircraft stored so that púšťali behind the approach without conflict. In the extreme case, the procedure used to waiting. After mastering all exercises focusing on the separation time is another way to add spacing - spacing using VOR equipment. Participants at the aircraft pousadzujú riadiály a plus allocate time and spacing. Exercise also been gaining momentum in the number of aircraft. The next pitch, which teaches graduate master, the NDB spacing. When it is assigned to track aircraft and they settle because preklesávaniu. Exercise is again a bit more challenging. Managing been complicated by the large number of departures and overflights in the area of responsibility. Eventually getting to the complications such as worsening weather conditions diverty, turbulence or icing, sanitary years, emergencies and the like.

5 SOFTWARE

Program to facilitate the work of pseudopilot during procedural training exercise program is not easy. Must be able to calculate the position on the background to the aircraft flight plan and then show the location on the timeline. It also defines the input to the individual objectives can easily manage.

A comprehensive program with full functionality is beyond the scope of this thesis and therefore I have decided to implement the basic functions of the program as well as a base of operations with the aircraft.

Program in the final version should be able to:

- From the time of entry into the area of responsibility displayed by the entire time course chosen arrival route.
- The entire time course of the trip according to the selected standard departure route
- The entire time course of flights from the time of entry into the area of responsibility to its abandonment.
- For arriving aircraft enter to wait a number of cycles Whether waiting
- Opportunity missed approach
- Approaches by the ILS and NDB procedures
- VFR flying circuits
- Possibility diverted.

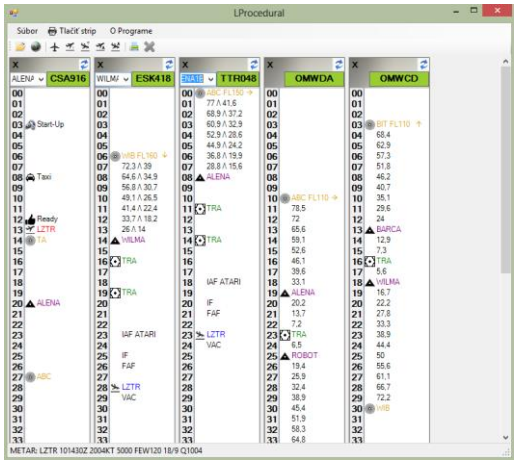

Fig. LProcedural program screen during pseudopilot operations

This program meets the requirements to run x86 and x64.

The entire development program for the simplification of procedural training I have chosen development environment Microsoft Visual Studio. NET 2012, Ultimate edition licensed DreamSpark Premium.

I decided that the whole program will combine three sub-parts. One part of the development program will be the development of flight control strips. This control will serve as a blueprint for completing the data and then print true copies of real flight strips.

In the next section, I developed a control to display the time during the flight. Do I forget the element according to the assignment of functionality and thus display the time course of arrivals, departures, overflights and functionality for different types of flights.

The last part of the development is focused on the link mentioned in the first two parts of one whole. The third part of the program that is graphical interface program takes care of loading databases, configuration program.

6 CONCLUSION

Air transport is the fastest and safest way to transport and the future is projected to grow. Therefore, it is necessary to persist in its security, which consists, among others, also for air traffic controllers to control as procedural, even though the aircraft equipment and its maintenance are high and it does not fail. The introduction of new advanced transport aircraft with jet propulsion increases the complexity of air traffic and leads to the introduction of new sophisticated and complex management systems and quality assurance, which are growing and demands on air traffic controllers. This is also the reason for performing the training of new and licensed air traffic controllers.

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