CHARACTERISTIC OF RANDOM PROCESSES AND PHENOMENA IN HANDLING OF AIRCRAFT, PASSENGERS AND BAGGAGE AT AN AIRPORT

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Summary. The aim of this work is to analyze the possibilities of measurement and evaluation of operational processes in random handling of aircraft, passengers and baggage for the needs of management and simulation modeling. Define operations performed in operating the aircraft, passengers and baggage, which have a random character and their parameters. Measured and statistically evaluated parameters selected processes to the needs of simulation modeling and improving management efficiency in this area.

Keywords: Random process, random phenomenon, check-in, aircraft handling, passenger handling, baggage handling, parameter

1. INTRODUCTION

Aviation is one of the fastest growing areas in the field of transport. Demand for air traffic is increasing every year and the depends and actuality of topic dealt, due to the improvement of services provided at the airport. The aim of this work is to analyze the possibilities of measurement and evaluation of operational random processes in operating the aircraft of passengers and luggage.

2. RANDOM PROCESSES AND RANDOM PHENOMENA

2.1 Random phenomena
Probability theory is the mathematical discipline that deals with the study of characteristics and laws related to the so-called. random phenomena. Due to extremely high incidence of these phenomena in nature and society very quickly after its establishment become one of the most powerful theoretical tools to investigate the laws of the real world.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

Random phenomena are generally denoted in capital letters from the beginning of the Latin alphabet or letters with the index. If considered random events are the result of the same random experiment, then there is a relationship between them which answers the logical relationships between statements, and any phenomenon can be attributed to a particular statement, therefore, considered that the phenomenon occurred.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

2.2 Random variables
In solving probability often we replace the original random phenomena with certain values of variables, which we will call a random variable. In the literature we can meet also with the name random variable. Take the space of elementary events E, respectively. phenomenon J field, which accounts for some random experiment. More than individual elemental phenomena we are interested in real function X (e) of these elementary phenomena that each elementary phenomenon e assigns

some real number. This assignment may not be mutual unique, ie. Various elementary phenomena can be assigned the same number.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

Random phenomena that we are surrounded by in the real world, usually do not have a numeric character. Their character is very different and depends on the natural internal structure of the phenomenon under investigation. As an example known problem of shooting at the target with circles. The result of each experiment (shot from guns and potential intervention) consists in the destruction of the target area at a point situated at some random distance from the center of the target. This distance, rather the approximation, for example, may be expressed in a system of concentric annular numbered. In this way, we studied a random phenomenon (a result of fire) transformed into numerical form. This idea has a universal character and is a connecting bridge between the real world phenomena, regardless of their numerical or any other substance and a range of numbers that can be applied in the apparatus of probability theory, statistics and other disciplines of applied mathematics. The numeric version of the phenomenon is called random variable. For application of probability theory we need just to realize that it is always understood as a special display.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

2.3 Random processes

The main tool of stochastic modeling of dynamic systems are random processes. It describes systems change over time related to the action of random factors. Implementation of processes that depend on random factors, there are some real functions. Terms of features, the conduct of which is not known in advance. After the expiry of the relevant period (in terms of ongoing phenomenon at the time) the course features are already clearly known and designed. In general, a random function may be defined as a set of random variables, dependent on a number of parameters, each of which is defined by a certain real number range.**Chyba! Nenašiel sa žiaden zdroj odkazov.**
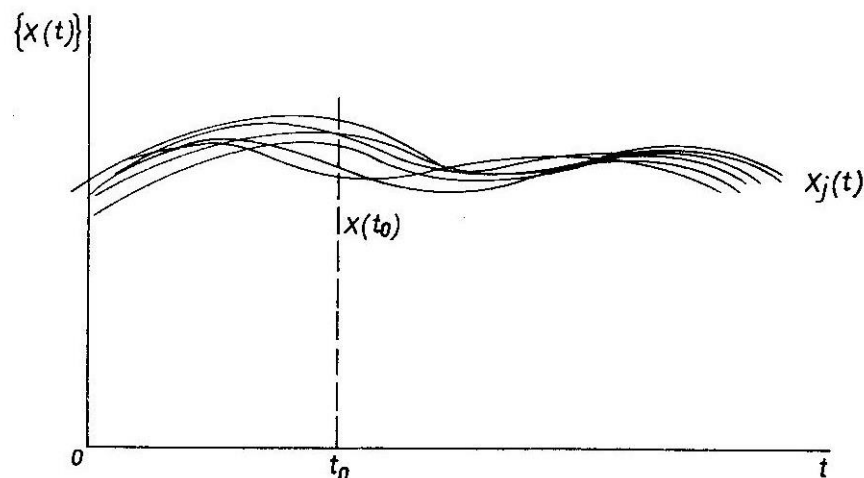

Figure. 1 Graph of realization of random proces

2.4 Random processes at the airport

There are some phases of air transport process that have random character: airline ticket purchase, transport to airport, preparing ofpassengers to flight, technical clearance of aircraft, security chceck (passengers, luggage), waiting before departure, boarding of passengers, on-board service, flight transport, disembark passengers to terminal,leaving the airport. Handling process – is defined as providing of handling services by airline (handling).
- **commercial:** handling of passengers, handling of luggage, handling of cargo**.**
- **technical:** aircraft guidance to stand, aircraft refuellin, connecting to ground power source (GPU), docking of boarding stairs, de-icing of aircraft and other.

3. PARAMETERS, AFFECTING CONDITION AND SEARCHED CONCLUSION

Parameters - parameters are usually referred to a small Greek letter Statistics and small Latin letters. The characteristics of the file (parameters) are fixed values, statistics vary from one random selection to the next. For each parameter, the basic set can be found relevant statistics. Statistics are like the basic files its probability distribution - these are random variables. Aim of the estimation parameters is to determine the approximate value of the parameter based on a core set of mathematical statistics. Data from a random sample can be used to estimate the parameters of the base set.

Affecting condition - expression or continuity, relied on by the other relationship. If A is true and B is the same value.

• Prerequisite (it has a valid B must pay A)
• sufficient condition (for force B is enough to apply A)

Searched conclusion - Outcomes role as an airport process. We are looking for him with the help of algorithm development, or the same number of steps in the calculation. The term reasonable inferences result of calculation.

3.1 Operational processes, their measurement and recording

The successful development of any system (whether mechanical, electrical, hydraulic, as well as biological and so on.) Assumes that its creator - designer knows the operating conditions under which a given system exploits. Knowledge of operating conditions, including the external environment, internal operation of the system and functioning of the services is essential for the design and evaluation of functional properties, operator comfort, dynamic and stable criteria, reliability and other specific characteristics which are directly or indirectly related and influenced by working load pressures , strain, velocity, acceleration and the like. Operating conditions are a source of operational processes, entering into all theoretical and experimental procedures, estimation and evaluation of operational characteristics of systems (structures). Their understanding and definition must predate before determining operational processes, but this, unfortunately, based on major constuctions (mainly mechanical) is not implemented.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

Operational processes can be divided into two broad classes:
- Deterministic processes - Their size can be determined for any moment of the future or the past of exact relations. They can be further divider on a periodic and aperiodic. Their analysis and application form part of the content of classical (deterministic) dynamics and the classical theory of elasticity
- Random (stochastic processes) - we can not accurately predict them, and we describe only the language of mathematical statistics. Depending on the time changes to their statistical characteristics are stationary or non-stationary. Their application is concerned, for instance. statistical dynamics or operational reliability of structures.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

Random processes are inherently more complex than deterministic processes, so it is natural that to work with them, as well as corresponding experimental device for their registration and evaluation are also more complex. Furthermore own conditions under which operational random processes scanned, have a decisive impact on the evaluation of the results, so they should be given much more attention than a deterministic process. The entire measurement task, recording and processing operational processes can be divided into several separate stages to be addressed with respect to specific conditions.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

3.2 Choice of measurement conditions and measured places

Choice of measurement conditions must always be aligned with the stated purpose of the measurement. While several reasons can be mentioned and the ensuing objectives for which we organize the online measurement of mechanical construction, basically always related to one of the activities:

- Getting the operational characteristics of the construction activities under certain specific conditions and in certain operating modes. The purpose of measurement can e.g. discover the cause of a failure of components in an occupational activity.
- Getting the characteristics of the activity structure or parts of it in the summary of typical operating conditions in order to obtain evidence to assess the dynamic properties and the estimation of reliability under typical operating loads.

While the first task can be characterized as an analytical approach to solving the reliability, the second task is integral features. In practice it can not give preference to either of them and the choice of measurement conditions will largely depend also on the advancement of project design and implementation. Probably at the stage of research and development aggregates, or even at the stage of increasing the reliability of individual aggregates, we prefer to experiment dedicated analytical nature. At the stage of assessing the overall reliability of the structures we are interested in an integral features and overall operational reliability. This will require knowledge of typical operating conditions.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

In the place we choose as a measurement parameter deformation, displacement and acceleration. Rarely are measured forces using load cells, pressure and speed. In terms of sensitivity and specificity record there is at present between the sensors and the corresponding apparatures practical differences. Sometimes the selection of the measured parameter specifies the physical sense of the models, sometimes our technical possibilities and conditions for the placing sensors.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

4. MODELING AND SIMULATION

The term is generally understood as modeling process to create, construction and building model of the original by the author, designer . This process is a verification of its validity, accuracy, respectively detecting the degree of similarity of the original model.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

Rationale behind the modeling is an abstraction of associating. Its principle is that of an object of a certain class considers only those properties that are common to all objects of the same class. Individual objects of the class appears as the abstract objects. Using abstraction associating formulate mainly of the examination, not the model, so it can not be confused with self-modeling.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

The term simulation is the process associated with the use of already created, verified and prepared model to solve a specific task. We can say that the simulation is to generate real or synthetic situation of their respective models.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

One way of modeling is simulation modeling. In the literature we can meet with a large number of definitions. It is a specific form of knowledge process. The basic principle of simulation systems is drawing conclusions about the system using simulated experiments with the simulation model. The simulation model is a system that imitates actual idea of a simulated system and its motion and is defined on an artificial material objects, created respectively adapted to this purpose.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

4.1 Modeling process throught Gantt charts

Gantt chart is a graphical method of planning a specific process. Diagram shows the time interval at which the task should fulfilled in relation to its current status. This method allows you to monitor the status of process and whether the particular activity is completed, in progress or has not yet begun. The aim of the project schedule, or the process is to create a realistic plan describing the progress and activities in implementation.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

To create a Gantt chart the schedule was chosen program MS Excel. On the vertical axis is defined generated 20 flights and the horizontal axis is the length of the reporting period. For the purpose of the thesis was the reporting period (24 hours) divided into 10 minute cyclic intervals that appear to be appropriate in responding to our work. In each row of the table is defined by a specific flight and its

specifications. When processing the schedule, it is necessary to define the following times for these flights:

- Number of Flight,
- Categories of passengers for which a flight is designated,
- Start time of check-in,
- End Time check-in,
- Arrival of the aircraft to the airport,
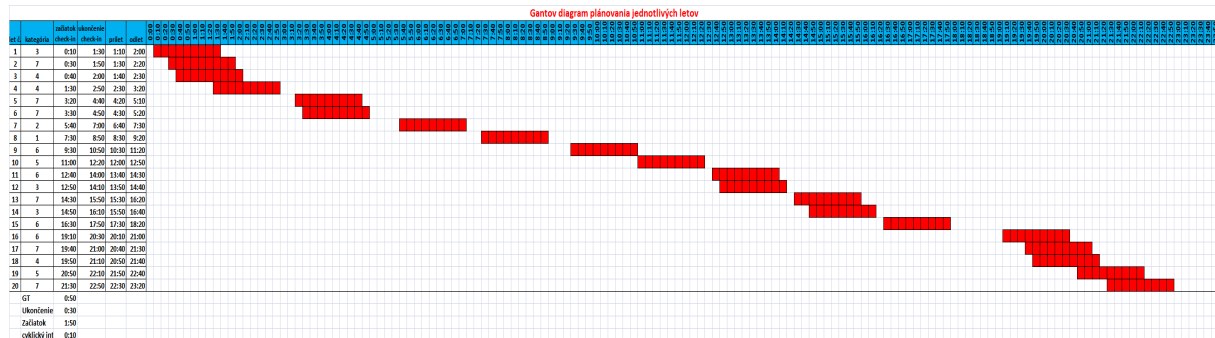- Departure of the flight from the airport.

Figure. 2 Gantt chart of schedule

Check-in process usually begins two hours before departure and is completed thirty minutes before departure. Length Gantt bar corresponds to that of 90 minutes, which actually defines the time, which is intended to check in passengers.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

4.2 Available capacity

Gantt chart available capacity counters in comparison with the schedule Gantt charts supplemented by a number of passengers, which is cyclical interval can be dealt with through a single console.

When creating a Gantt chart of the available capacity it is essential to work with times to accommodate passengers in specific categories that were generated by the random generator. The aim is to determine how many passengers can pass through check-in every 10 minutes. We accomplished this by analyzing data generated by various categories of passengers. A prerequisite in this case is not to exceed a cyclic interval. The data obtained by analysis is then necessary to enter the flight schedules by category of passengers.
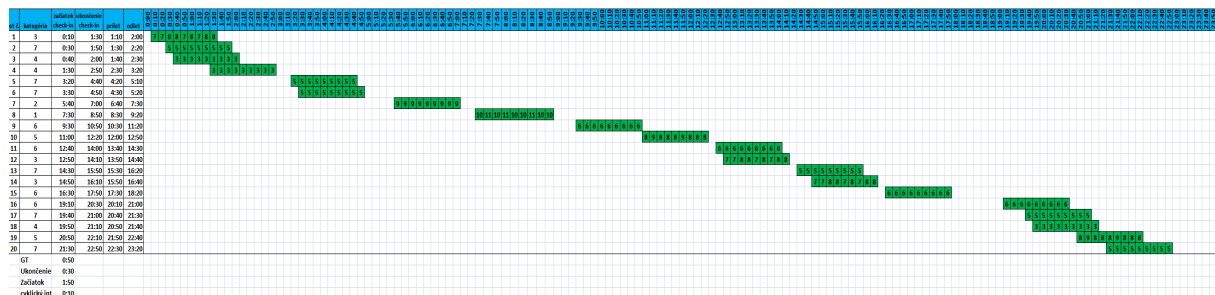

Figure. 3 Gantts chart of available capacity

Analysis indicated that:

- For the first category of travelers the available capacity of one check-in pult across cyclical intervals determined on 10,11,10,11,10,10,11,10,10

- For the second category of travelers the available capacity of one check-in pult across cyclical intervals determined on 9,9,9,9,9,9,9,9,9
- For the third category of travelers the available capacity of one check-in pult across cyclical intervals determined on 7,7,8,8,7,8,7,8,8
- For the fourth category of travelers the available capacity of one check-in pult across cyclical intervals determined on 3,3,3,3,3,3,3,3,3
- For the fifth category of travelers the available capacity of one check-in pult across cyclical intervals determined on 8,9,8,8,8,9,8,8,8
- For the sixth category of travelers the available capacity of one check-in pult across cyclical intervals determined on 6,6,6,6,6,6,6,6,6
- For the seventh category of travelers the available capacity of one check-in pult across cyclical intervals determined on 5,5,5,5,5,5,5,5,5

4.3 Results of modeling and simulation

Evaluation of the results of modeling work is carried out by means of tables created in MS Excel. The tables are based on model values that are presented on Gantt charts. They are listed in order of individual flights in the timetable and are further identified specific categories of passengers on this route. The tables are a simple way to receive data for an assessment process to accommodate passengers at check-in counter.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

Table 1 compare the capacity of the first flight

Flifght 1 – compare of the capacity for the travelers of category III.									
Capacity:	Number of passangers:								
Available	7	7	8	8	7	8	7	8	8
Needed	5	10	15	20	25	30	25	10	1
Available + out of capacity			18	30	47	70	87	90	83
Out of capacity	3	10	22	40	62	80	82	75	
Flight 1 - compare of the capacity for the travelers of category III. With use of 3 check-in tables									
Capacity:	Number of passangers:								
Available	21	21	24	24	21	24	21	24	24
Needed	5	10	15	20	25	30	25	10	1
Available + out of capacity						34	35	24	1
Out of capacity					4	10	14	0	-23

Available capacity is the total volume of passengers that is operating device (check-in counter) able to fit in some time. The tables are highlighted in green.

The required capacity is the actual capacity of passengers registered for the flight to be fitted with check-in counters. The tables are marked in yellow color .

The required capacity addition s number of passengers who could be because of time indicates the total number of passengers waiting to check in for the next cyclical interval.

Passengers who have not been taken care of in a cyclical interval of check-in are listed in the "Out of Capacity" and are then queued to the next cyclical interval. The table shows the number of such passengers in red.

Blue tables are moments in time when queues no longer occur, all passengers have been taken care of.**Chyba! Nenašiel sa žiaden zdroj odkazov.**

5 CONCLUSION

The primary aim of this study was to analyze the possibilities of measurement and evaluation of operational processes in random handling of aircraft, passengers and baggage at the airport. A

particular process, which I have chosen for field work is the solved clearance of passengers at check-in counter.

By using the program to generate random numbers, I created a fictional schedule, the application and modeling using Gantt charts I reached the output values. According to these values in Tables I subsequently reviewed and came to some conclusions that were likely to develop queue before check-in counter, or the number of check-in counters that it is necessary to use equipment that were all passengers of a particular flight.

The contribution of this work I see the possibility of using the model as a basis for the need for more comprehensive and more specific modeling operational processes. With some variations, the model can be adapted to the required conditions and input data, the user needs to follow. It is flexible with respect to time, which can be utilized in the prevention of potential risks. The model can be read also other facts that may help you solve problems. An example is the time in which it will be involved in the process of further check-in counter, which could result in reducing the cost of operation than the wages paid to employees.

The work is dedicated to one particular process because the scope of the subject is so extensive that it had to be righted comprehensive research which would take into account all the factors entering into the process.

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