

MEASUREMENT AND EVALUATION OF RANDOM OPERATING PROCESS BY HANDLING OF AIRCRAFTS, PASSENGERS AND LUGGAGE

Ján Bačík

Technical University of Košice
Fakulty of Aeronautic
Department of Air Traffic Management
Rampová 7, 041 21 Košice, Slovak Republic
jan.bacik@tuke.sk

Iveta Podol'aková

Technical University of Košice
Fakulty of Aeronautic
Department of Air Traffic Management
Rampová 7, 041 21 Košice, Slovak Republic
iveta.podolakova@gmail.com

Miroslav Džuba

Technical University of Košice
Fakulty of Aeronautic
Department of Air Traffic Management
Rampová 7, 041 21 Košice, Slovak Republic
miroslavdz@gmail.com

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Abstract

By implementing of statistical methods to the process of evaluation of measured variables determining the behavior of complex systems, we receive information that reveal hidden relationships between variables or states of the system. These qualitative data are very important for the analysis of investigated system. This article deals with handling process at the airport, with a focus on ensuring the efficient and early handling of aircraft, passengers and luggage, as well as the need for measurement and evaluation of these processes.

Key words

simulation, modelling, random process, system

1. Introduction

Random processes are more complex than deterministic processes, so it is natural to work with them, as well as with corresponding experimental devices for registration and evaluation which is also complicated. Their own conditions in which random operating process senses have major impact to the quality of evaluation results. So it is necessary to give them much more attention than to deterministic process. Selecting of measuring chains depends on specific conditions and mainly on technical equipment of the measuring apparatus. We usually performs the operating measurments in order to assess operating stress (or estimating lifetime) or dynamic properties of construction, capacity utilization and utility subsystems and others.

2. Modeling and simulation

Modeling and simulation are very wide terms and people from different disciplines projects in them different facts. Those terms represents in the field of economics e.g. prediction of price trends, modeling of growth of economic indicators and so. We often meet with the design of equipment and buildings in aerospace industry, which properties must be examined earlier than these facilities or buildings will be created.

Whether the draft meets the stated requirements of object (such as heat resistance of object, durability of the building against the earthquakes) is examined by using CAD models and simulations. From previously mentioned facts is clear that terms of modeling and simulation in different disciplines (as well as inside same science discipline for different fields) represent another entity that have some characteristics in common.

2.1 Routing of modeling and simulation

Technique of modeling and simulation depends on progress in such disciplines in which models are formulated. It contribute by its results to continuous development as a independent scientific and engineer discipline. Next progress depends on results from design and development of new technical equipments, which will be available for simulation in the future. Modeling and simulation are important part of technicians word and engineers which performs work in variety of industries. To fulfill the challenges in this area is crucial to have programs and tools which facilitate the creating of complex models at which they spend a lot of time. Advances in science are getting faster and we meet them at every step. Development shows that there is nothing unknowable in our world and that every problem will be solved sooner or later. Scientific knowledge is applied in human's life much more effective and science becomes a fair production force.

2.2 Simulation in management

In the application of simulation methods are often present two kinds of simulations:

- **Factor simulation** - is based on changes of exogenous variables and it examines their impact at endogenous variables,
- **Target analysis** – examines the impact of endogenous variables to exogenous variables and allows pointing to meet the needs of target variable.

Simulation in management are important for the forecast of variable development. Simulation is about creating of combinations that could occur under certain assumptions in the future. One of the most important question is that – which endogenous variables can be subject of simulation. There are certain future states in development of goods that have constant development and can not be greatly changed. For example strategic raw materials, domestic and foreign investment, job offer, space distribution and so. The object of simulation can be variables that can be affected by managers. It is necessary to note that simulation allows finding solutions even under unfavorable conditions and alerts managers to the need of changes. Procedure of simulation of management process is based on knowledge of behavior of real economic phenomena. The development of investigated phenomena can be illustrated by simulation model.

3. Operating processes and their measurement

Successful creation and establishment of any system predict that its creator – designer knows the operating conditions under which can system exploit. Knowledge of operating conditions involving the external environment, internal operation of a system and service activity is important for design and evaluation of functional properties, operator comfort, dynamic and stable criteria, reliability and other specific features that are directly or indirectly conditioned or affected by operational loads, physical conditions and so. Operating conditions are thus factors of operational processes entering into all the theoretical and experimental procedures, estimation and evaluation operating characteristics of systems (objects). Their knowledge and definition have to proceed before determination of operating processes and use of objects.

3.1 Selection of measurement conditions and measured places

Selection of measurement conditions must always align with the goal of measurement. It is always basically related to one of the two tasks: gain operational characteristics of object (system) activity under specified conditions and with certain operating modes. The aim of such measurements can be reveal the causes of failure of any component in a specific work activity, assessment of stability under extreme conditions and so, determination of the characteristics of system operation or its parts in the summary of typical operating conditions in order to obtain data for the assessment of dynamic properties and calculation of reliability under typical operating loads. While the first task can be characterized as an analytical approach to solving of reliability the second task has integral characteristics. It is not possible to favor either one in practice and selection of measurement

3.2 Random process

Random process is random function of time. The value of a random function is random variable for each value of independent variable, so random function is represented by an infinite set of random variables that depends on independent variable (with random processes at time). The individual items of the set can be determined experimentally – it is called realizations of random process. Random process, as term from mathematical point of view is understood as set of all possible realizations with common statistical characteristics. From the physical point of view is random process a phenomenon that progress random in time. Even if we know progress of few realizations, we can not determine progress of next implementation. Knowledge of progress of realization in past also does not determine the progress of that realization on the future.

3.3 Random phenomenon

A phenomenon that as a result of random experiment may or may not occur (eg throwing dice). We can not exactly determine whether a random phenomenon occurs, but we can calculate probability of its occurrence. We know:

- **Compatible random phenomena** – we can not exclude their occurrence (eg we can not exclude that in the act of playing two dice at the same time not fall the same numbers).
- **Incompatible random phenomena** – if any two events can be excluded (eg if roll one dice than can not fall the same values at the same time).

4. Operations of aircraft passengers and luggage at

There are some phases of air transport process: airline ticket purchase, transport to airport, preparing of passengers to flight, technical clearance of aircraft, security check (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 refuelling, connecting to ground power source (GPU), docking of boarding stairs, de-icing of aircraft and other.

4.1 Economic aspects to determining the performance of the airport

Productivity and performance of airports are similar to the airlines, analyzed in detail and compared in order to find the way to increase their productivity and reduce costs. Airports mainly uses performance and economic indicators.

The **performance indicators** include:

- number of aircraft movements (movement of aircraft means an aircraft take-off or landing). This indicator is important for evaluation and planning of airport capacity, runway systems, taxiway systems and aprons. It is important to monitor of its value during rush hours that are important to determining the required capacity of airport.
- number of maximum takeoff weight MTOW. In practice there are MTOW for the type of aircraft or for particular aircraft and it has impact to the landing fees.
- number of passengers. It monitors the number of departures, arrivals, transfers, transits and total number of passengers.
- numbers of handled cargo tons. It monitors the number of cargo clearance at cargo terminals.

The **economic indicators** include:

- **quality indicators**, by which it is possible to determine degree of customer satisfaction. One of them is timeliness or punctuality. For that reason are monitored any deviations from the schedule, minutes of delay, which are then analyzed according to its causes of fault. Another important parameter of quality is impeccable transportation of passengers luggage, respectively cargo. An important sign of quality of service is waiting time to check-in counters at passport and customs control. The main objective of airports is to minimize the waiting time, while it is necessary to find a balance between waiting time and costs to achieve that.
- **value indicators** which govern each economic subject. These indicators include average revenue from airline fees per passenger which is important in the competitive relationships between airports themselves. Another indicator is the average revenue from business activities per passenger or unit of rented space. This indicator is used for monitoring the effectiveness of rent by tenants and individual business areas.

5. Measurement and evaluation of processes of airport

As the main factor associated with the type of aircraft is aircraft size and its associated time of technical clearance. Other factors that may affect the length of clearance may be type of company and type of flight. Extension of necessary time to clearance of aircraft is an extension of its non-productive time and reducing of its average daily use. For more effective passenger handling are developed new methods of traffic at airports, more advanced ways to separating flows of passengers, goods and cargo. The various companies vary the requirements for cleaning of aircrafts, refuelling and catering. The aim of air transport is to reduce passenger's required time spent at airport from their arrival to boarding to 15 minutes for a short flights and 30 minutes for a long distance flights. Implementation of the new technologies at airports such as web or mobile check-in systems to simplify traveling and increasing passenger comfort is in fact slow but surely becoming commonplace of airports with more traffic.

Implementation of self check system to airports meant a reduction in staff costs, speed up handling process and reduction of waiting time of passengers. Ensuring of process of air transport of passengers,

luggage, cargo and mail needs material's and technical basis based on widely using of mechanization and automation.

5.1 Analysis of airport processes

In analysis of airport process we monitor:

- from what parts the process is composed,
- parameters of various parts of airport process,
- input parameters,
- method of measuring of parameters,
- how can be these parameters affected by conditions,
- which variables and constants exit from operations of airport process,
- searched result,
- result (in what measurable units),
- how can be found result used for other tasks sucha as:
 - management (management tasks),
 - optimization (increase efficiency),
 - quality (determine the capacity of objects),
 - quality (reliability),
 - security (in field of SAFETY a SECURITY).

5.2 Use of the results measurement of airport processes

Optimizing of processes in the operation of aircrafts, passengers and luggage depends on credibility, timeliness, accuracy and selection of critical parameters and on determining the conditions that affect the applicability of obtained conclusions.

In individual performance and economic paramters of airport is necessary to monitor the change (distribution) of their values during day, week, month and year, possibly trends of its development over several years.

An important element of scientific forecasting is modeling - a method of creating and exploring analogue object, which is called its model. The measured values of process parameters of handling of aircrafts, passengers and luggage will serve as input for airport porcess model that allows you to optimize required number of resources (equipment and staff) for each handling subsystems.

6. Conclusion

It is neccessary that the monitoring, evaluation and optimization of costs and processes of airport became a permanent part of menagement process. Costs of airport infrastructure are pretty much independent at actual performance conducted at airport because they are associated with required capacity of airport. Therefore it is important to expand airport capacity as expand demand for air travel. Any larger or smaller airport has a partial influence on its surroundings, whether positive or negative. Regard to growing use of air transport is necessary to try not underestimate and reduce negative influence as far as possible. Measurement and evaluation of parameters of airport processes is necessary in case that the airport has made progress in number of flights and passengers, so there will be situation where it would be necessary to increase the number of parallel service lines or implementation of new technologies to streamline the airport operations. It is also necessary in decrease of number of flights and passengers, when is need to reduce tha capacity of handling subsystems in order to achieve the desired efficiency.

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