Chapter 2

Models of Decision-Making Operators of Socio-Technical System

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ABSTRACT

In this chapter, the authors present Air Navigation System (ANS) as a Socio-technical System (STS). The authors present models of decision making (DM) operators of STS, such as the deterministic models obtained for using network planning; the stochastic models obtained for using decision-tree; models in uncertainty obtained for using criteria Vald, Laplace, Savage, Hurwicz and other. The authors presented also DM models of operators in ANS, such as the neural network models, fuzzy models, the Markov network models, GERT-models for modelling and forecasting of behavioral activity of ANS’s Human-operator (H-O) in flight emergencies situation. The scenarios of developing a flight situation in case of selecting either the positive or negative pole in accordance with the reflexive theory have been obtained. They demonstrate some examples with DM’s deterministic and stochastic models for engineers, pilots, air traffic controllers, Unmanned Aerial Vehicle (UAV) operators, managers etc. In addition, the chapter presents some examples of DM models developed by the author and students at National Aviation University.

DOI: 10.4018/978-1-5225-3108-1.ch002
MODELS IN AIR NAVIGATION SYSTEM AS SOCIO-TECHNICAL SYSTEM

Air Navigation System referred to STS within which close co-operation between human and technological components occur (International Civil Aviation Organization [ICAO], 2002; 2004; 2009; 2013). Actual represent models of DM by the ANS’s operator in emergency situations (ES). Currently, one of the main strategic problems of mankind on the path to sustainable development is the safety and stability of technogeneous production. It is already known that technogeneous production is a complex system that contains interrelated technical, economic and social objects. For many years, scientists have been research in the field of improving complex system as STS, aviation safety, decision models, problem of learning from failure, airline accidents of human factors (HF), human error, etc. (Emery, 1959; E.Trist, 1981; Clegg, 2000; Kuchar $ Yang, 2000; Pasmore, 2001; Carayon, 2006; Hendrick, 2006; Mumford, 2006; Fedja Netjasov. 2008; Baxter & Sommerville, 2011).

As a result of the previous studies the factors which affect the DM by an ANS’s H-O have been determined, namely: level of knowledge, skills, abilities, preceding experience as well as the factors of professional and non-professional nature (psycho-physiological, individual-psychological, social-psychological factors). The systemic analysis which has been carried out as well as the formalization of the factors which affect DM by H-O in the conditions of the progress of a flight situation from normal to catastrophic obtained (Kharchenko, Shmelova & Sikirda, 2011, 2012, 2016; Shmelova, & Sikirda, 2012, 2013a, 2013b, 2015, 2016, 2017) and obtained models of preferences by an H-O under the influence of social-psychological factors; preferences by a H-O depending on the significance of individual-psychological factors in the conditions of development flight situations from normal to catastrophic ones; the models of diagnostics of psycho-physiological factors at the score of monitoring the emotional state of H-O; the models of personality, behaviour and activity of Air Navigation system’s H-O and models of DM in ES etc. The authors of this manuscript researches are: decomposition of the process of DM by H-O ANS, systemic analysis, and formalization of the influence of the factors on the DM within ANS treated as complex STS; working-out of models DM by H-O in socio-technical ANS (DM under Certainty, DM under Risk and DM under Uncertainty); calculation the scenarios of the flight situation development using GERT’s and Markov’s networks (Kharchenko, Shmelova & Sikirda, 2011, 2012, 2016; Shmelova T., Sikirda Y. 2012, 2013,
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