

## Chapter 29

# Analysis of Decision-Making of Operators in Socio-Technical Systems

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### ABSTRACT

*In this chapter, the authors present Air Navigation System (ANS) as a Socio-technical System (STS). The evolution of Human factor's models is presented (from 1972 to present time) and the role of society in human factor (HF) models is defined. The authors made an analysis of the International Civil Aviation Organization (ICAO) documents on risk assessment and the impact of the social environment on the aviation system. The authors obtained the results of the evaluation of non-professional factors: determination the social-psychological impact on DM of human-operator (H-O) by identifying the preferences; diagnosing individual-psychological qualities of H-O ANS in the development of flight situation; monitoring of the psycho-physiological factors as emotional state H-O ANS. Authors demonstrate some interesting advantages offered by the new methodology of forecasting the behavior of the operator in emergency situation (ES).*

### THE EVOLUTION OF HUMAN FACTOR'S MODELS

The aviation system is a complex system that requires investigation of the human contribution to safety and an understanding of how human performance may be affected by its multiple and interrelated components such as technical, political, physical, social, economic culture etc. (Cross-Cultural Factors in Aviation Safety, 2004). The HF remains a major cause of aviation accidents. That is why current

DOI: 10.4018/978-1-7998-5357-2.ch029

management system needs to improve. The HF as a term requires a precise definition because when it is used in everyday life, it is often encompasses all aspects of human activity (Human factors training manual, 1998; Human Factors Guidelines for Safety Audits Manual, 2002). People are the most flexible, adaptable and important element in aviation system and the most vulnerable in terms of opportunities effect on its activity. At the initial stage of development of aviation, many problems have been associated with exposure to human noise, vibration, heat, cold and acceleration forces. But optimization of the human role in complex systems is related to all aspects of human activity, such as: DM processes and knowledge; design configuration displays, controls and equipment cockpit and cabin; maintaining communications and software; preparation of plans and maps.

Human factor and its effects on safety performance continue to evolve The theory of the HF is gradually developed, tested and institutionalize. From the end of the previous century and now ICAO presents the cultural interfaces and systematic approach in aviation safety with reference to main establishment of conceptual of safety models. There are many circulars, documents and reports of ICAO presented conceptual models of HF and evolution of HF's models (Human factors training manual, 1998; Human Factors Guidelines for Safety Audits Manual, 2002; Cross-Cultural Factors in Aviation Safety, 2004; Safety Management Manual, 2013; State of Global Aviation Safety, 2013, ICAO Safety Report, 2014): the SHEL, SHELL, SHELL-T, SHCELL's models; Reason's model of latent conditions; the Threat and Error Management (TEM) model and other models of HF. In the centre of the SHEL model is a

*Table 1. Evolution Human factor's models*

Years	Models	Content of Model	Content of Stage of Evolution Human Factor's Models	Stages
1972	SHEL	Software (procedures) - Hardware (machines) - Environment - Liveware	Professional Skills Interaction Errors	I
1990	Reason's "Swiss Cheese Model"	Active errors - Latent errors - Windows of opportunity - Causation chain		
1993	SHELL	Software (procedures) - Hardware (machines) - Environment -Liveware - Liveware (humans)		
1999	CRM	Crew - Resource - Management	Cooperation in team Error detection	II
2000	TEM	Threat and Error - Management		
2000	MRM	Maintenance - Resource - Management		
2004	SHELL-T (SHELL-Team)	Software (procedures) - Hardware (machines) - Environment – Liveware - Liveware (humans) - Team	Culture Safety Error prevention	III
2004	SCHELL model and CRM	Software (procedures) - Culture - Hardware (machines) - Environment - Liveware - Liveware (humans) / Crew - Resource - Management		
2004	LOSA	Line - Operation - Safety - Audit		
2009	HEAD	Human - Environment - Analysis - Design		
2010	HFACS	Human Factors - Accident - Classification - System		
2013	SMS	Safety Management System	Safety Management Safety balance models Minimization of errors	IV

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