

# HUMAN BEHAVIOUR MODELLING IN TOOLS FOR AIR TRAFFIC MANAGEMENT CHANGE IMPACT ASSESSMENT

## INTRODUCTION

Air Traffic Management (ATM) is a high complexity field in which technical systems and human actors work cooperatively. It relies on a distributed architecture, where information and tasks are properly allocated to different agents in different phases. In the assessment of new ATM concepts, architectures and procedures, the understanding of human behaviour could be critical for the success of new solutions, since it may affect and may be affected by it.

In EvoATM agent based model, one of the most challenging part aims to propose a model of human behaviour for fast time simulations. Hence, EvoATM model relies on the Air Traffic Controllers' behavioural and cognitive aspects, as the core part of the foreshadowing of new situations under test. With this aim, the most relevant Human Factors and contextual variables have been identified in relation to some specific working scenarios and have been applied to a selection of ATM use cases and tasks. Here is presented the EvoATM methodology applied to the human variables, including cognitive and socio-cultural aspects, and are described the rules for their application into the Functional Resonance Analysis Method (FRAM).



[www.evoatm-project.eu](http://www.evoatm-project.eu)



EvoATM project has received funding from the SESAR Joint Undertaking with grant agreement No 783189 under European Union's Horizon 2020 research and innovation program.

## THE PROBLEM

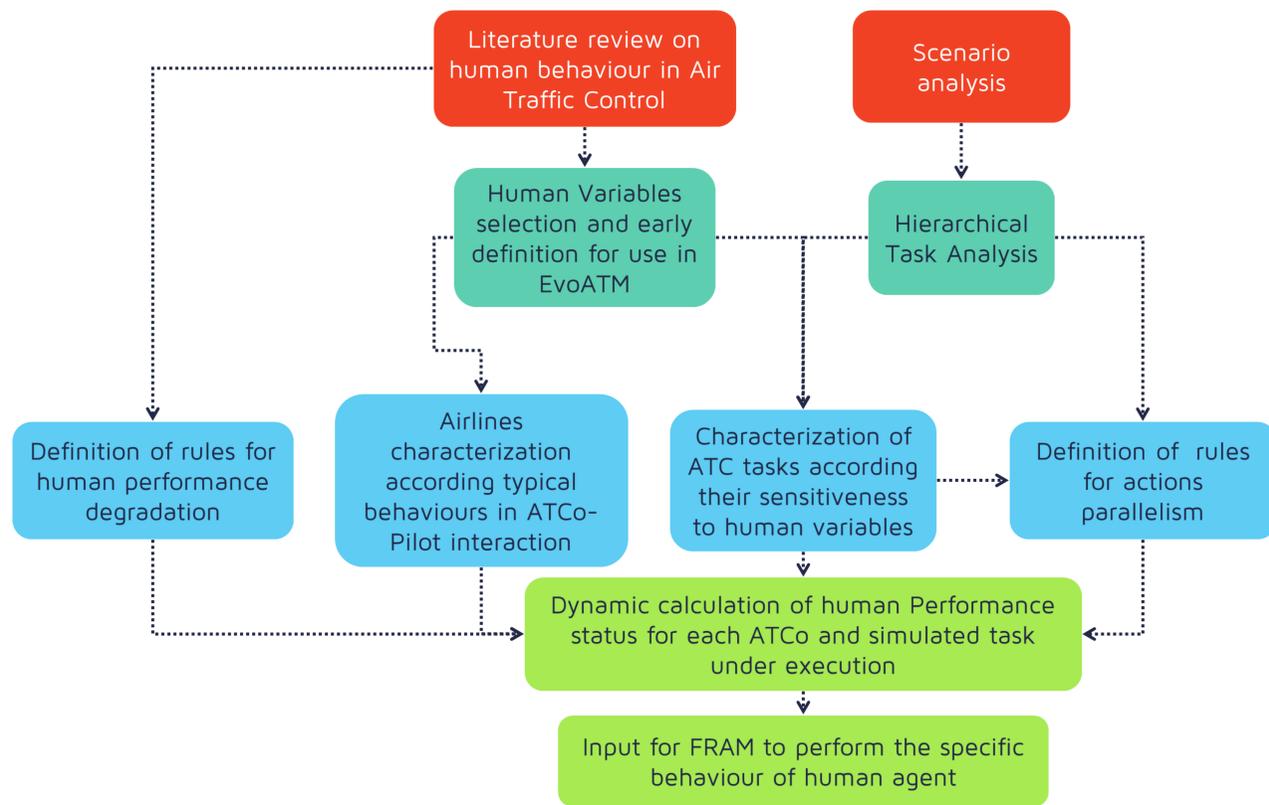
EvoATM aims to support the problem of the change impact assessment in ATM by defining an enabling methodology for modelling and simulation, thus allowing a deeper understanding of the human behaviour. The EvoATM methodology enables to model:

- the key aspects of human behaviours
- the behaviours of technical components that are integrated in the reference system
- the execution of the procedures that are applied by the involved actors
- the relations amongst the involved actors
- the description of the operative environment

## THE HUMAN MODELLING APPROACH

The review of the Human Factors influencing the Air Traffic Controllers (ATCo) behaviours in ATM resulted in the definition of a set of human behaviour variables specified in relation to ATCos tasks, organizational context and traffic situation affecting the human behaviour.

ATM agents modelled by EvoATM are represented according the Functional Resonance Analysis Method (FRAM) formalism. Human Agents modelling in EvoATM focuses on Air Traffic Controllers (ATCos), whilst variability of Pilots' behaviour is represented with a higher level of abstraction thanks to a characterization of airlines' standard interactions with ATCos.



## THE HUMAN VARIABLES IN AIR TRAFFIC CONTROLLER TASKS

The tasks characterization resulting from the EvoATM modelling takes in consideration both the human and context variables:

- time sensitiveness
- task complexity (number of alternative and optional actions in a task)
- behavioural level (skill/rule/knowledge based)
- resources allocation (human/computer/human with computer assistance)
- static personal variables for relevant task completion
- dynamic cognitive variables relevant for task completion
- static cognitive variables relevant for task completion
- contextual socio-cultural variables relevant for task completion

## THE HUMAN PERFORMANCE CONCEPT

EvoATM human behaviour model considers that some combination of socio-technical variables at a given time might result in a less efficient execution of the given human tasks. As a consequence, the human agent might not be in the optimal nor good condition to perform the expected job and correctly contribute to the overall ATM system. The Human Performance degradation in EvoATM represents the effect of human behaviour variability on the overall ATM system and its single parts, exploiting the fact that Hierarchical Task Analysis, conducted also in the purpose of simulation engine functioning, has derived from the reality a nominal duration for each ATCos actions.

Basing on this, EvoATM has set specific rules that enables the simulation engine to model the nominal or degraded behaviour of the human agent, combining traffic complexity, past traffic events and airline characteristics with the task characterization and the human variables.