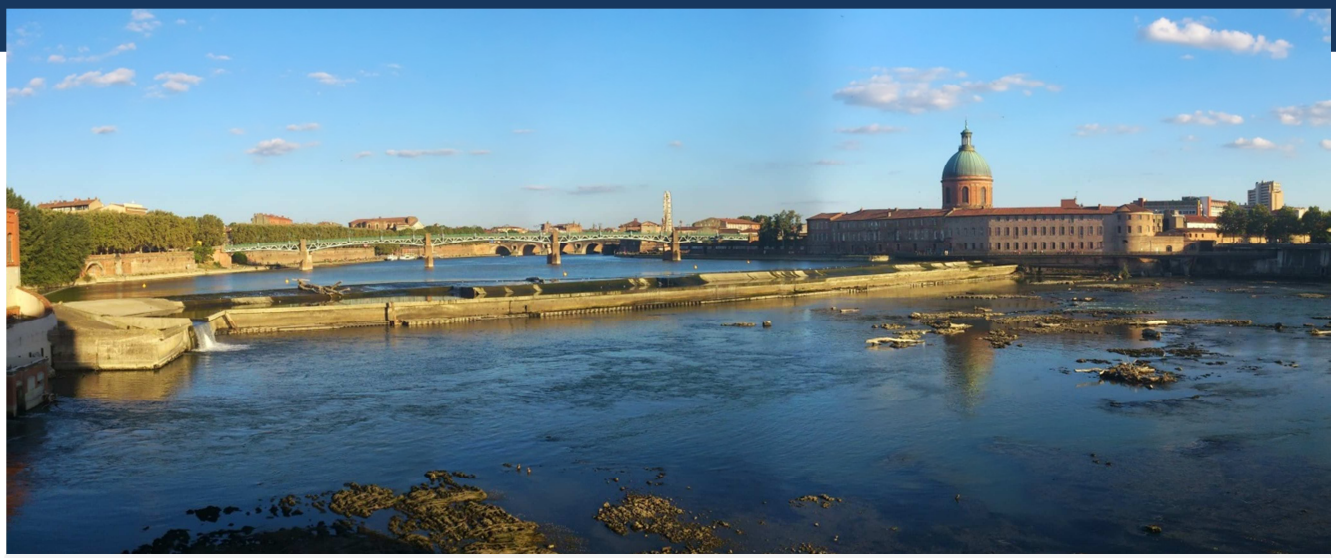

The 1st International Conference on Cognitive Aircraft Systems – ICCAS

March 18-19, 2020

https://events.isae-supaero.fr/event/2

Scientific Committee

- Mickaël Causse, ISAE-SUPAERO
- Caroline Chanel, ISAE-SUPAERO
- Jean-Charles Chaudemar, ISAE-SUPAERO
- Stéphane Durand, Dassault Aviation
- Bruno Patin, Dassault Aviation
- Nicolas Devaux, Dassault Aviation
- Jean-Louis Gueneau, Dassault Aviation
- Claudine Mélan, Université Toulouse Jean-Jaurès
- Jean-Paul Imbert, ENAC

Permanent link : https://doi.org/10.34849/cfsb-t270

Designing for Flexibility: A Human Systems Integration Approach – From rigid automation to flexible autonomy in aerospace operations

Prof. BOY, Guy Andre

Content

For a long time, automation and, more recently, human-centered design (HCD), were developed to enhance safety, efficiency and comfort of civil and military aircraft. However, if automation led to considerably effective results in a large number of situations, experience shows that automation can become a very rigid tool in unexpected situations. Indeed, automation consists in compiling operational knowledge on specific domains (e.g., handling qualities and flight management) and providing aircrew with either procedures (automation of people) or implemented algorithms (automation of machines). Procedure following and automation use have been studied for the last three decades. Both types of automation lead to rigidity, and even danger, when the current situation is out of their domain of validity. In such situations, human competence and the quality of organizational setups become crucial resources. They require flexibility to solve problems in real time and often under pressure. Therefore, what kind of technological, organizational and people's knowledge and co-adaptation would be appropriate to provide operational flexibility in a large variety of situations, including unexpected situations? An answer to this question relies on autonomy: autonomy of people and autonomy of machines, as well as autonomy of organizations of people and machines. Autonomy is a matter of knowledge, reasoning, sensing and collaboration. Indeed, autonomous agents require coordination to be able to cooperate and insure local and global safety, efficiency and comfort for cooperation, the agency they constitute. In this paper, an agent is considered as a society of agents (Minsky, 1985). Agents in artificial intelligence (AI) are systems in systems engineering, where the concept of system is a representation that encapsulate machines and people able to act in their environment. Therefore, an agency of agents is a system of systems that places the human element and cognitive machines at the center of the overall system. We need to further develop a systemic approach that harmonizes system's structures and functions of Technology, Organizations and People (the TOP Model). This paper presents such an approach with examples in the aerospace sector by showing the evolution of human factors and ergonomics (e.g., the shift from human error paradigm when people are problems to human engagement where people can be solutions together with and within appropriate cognitive systems), recent advances in AI (e.g., deep learning in complex situations, AI in engineering design as well as certification and homologation of AI-based systems), human computer interaction (e.g., visualization techniques enhancing situation awareness and decision-making), and systems engineering (e.g., human systems integration based on virtual HCD and tangibility models and metrics). Consequently, designing for flexibility has become a mandatory approach in HCD. It will be presented as the FlexTech approach together with examples in aeronautics, and more specifically future air combat systems focusing on unexpected event management.

Keywords : Man-machine cooperative techniques