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THE FRENCH AEROSPACE LAB

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# POST-DOCTORATE PROPOSAL

**Title : DIALOG - Deciphering Intents of Air traffic controllers, workLOad assessment and Gaze analysis to enable their efficient and trustworthy collaboration with AI**

Reference: **PDOC-DTIS-2024-04**
*(to be recalled in all correspondence)*

| **Start of contract: Oct. 2024** | **Application deadline: May, 1st, 2024** |
|---|---|

**Duration: 12 months, possibly extendable up to 24 months - Gross salary: about 38 k€ (medical insurance included)**

**Keywords**

Human-AI Teaming, Air traffic controller, Workload, Explainability

**Profile and skills required**

PhD in cognitive science, ergonomics, human movement science or related area.
Knowledge in theoretical frameworks of human-system interactions, or human-automation cooperation.
Experience in setting up, running and analyzing human-based experiments (at least behavioral; physiological is a plus).
Experience in operational environment studies, especially in air traffic management, is appreciable.
Good English, communication skills.

**Presentation of the post-doctoral project, context and objective**

This post-doctoral project is funded by the SJU (SESAR Exploratory Research European fund) to work on the DIALOG project which aims to evaluate how using AI-based digital assistants to read air traffic controllers' (ATCOs) intents and goal through voice recognition and biometrics can help prevent difficulties and anticipate ATCOs needs. We wish to decipher pilots' requests (through AI-based voice recognition) and combine it to knowledge about traffic situation as well as assess ATCOs' state (through physiological measures) in order to infer their intent and perform function allocation accordingly. It involves a consortium of six partners from five different countries.

The aim of the post-doctoral researcher at ONERA will be to examine the collaborative aspect of the artificial assistant. In particular, the nature and format of the information to be provided by the artificial partner in order to provide effective and acceptable assistance to the human partner will be examined. In that sense, the post-doctoral researcher will be involved in 3 main tasks.

The first task consists in performing an analysis of ATCOs' tasks according to their routines and pilot requests. This analysis is critical to ensure that the artificial partner is able to produce support for the ATC to carry out the task. For this, we will perform human factors-based task analyses (Hierarchical and Cognitive task analyses; HTA and CTA). They will be complemented by vocal processing and identification of pilot's requests allowing to infer ATCOs goals.

The second task aims to develop an artificial partner that can adapt to the state of the human operator. Here, the base of our research is to work on two aspects. First, by evaluating the state of the controller through behavioral and physiological data analysis. In collaboration with Radboud University, we will use machine-learning algorithms and data fusion to determine the ATCO workload. For this, we will use advance state-of-the-art algorithms on unobtrusive real-time objective workload assessment methods in the ATM context. These biometrics will enable transition to higher automation levels by providing the information about when and why an AI assistant should take over functions and/or initiate actions. The second aspect aims at evaluating ATCOs momentary attention allocation using behavioral as well as eye-tracking measures. The aim is to be able to determine at any time where the controller focuses his.er attention in order to anticipate, based on the task analyses and pilot's requests deciphering, his.er future needs. The aim of these first two tasks is to provide the right information at the right time, depending on the operator's activity and state.

Finally, the third contribution of the post-doctoral fellow will focus on the exploration of different ways of collaboration among ATCOs and AI assistants. According to models in the literature, one leverage to promote human-AI collaboration is to improve system transparency and intelligibility. Notably, transparency afford operators comprehension about an intelligent agent's intent, performance, future plans, and reasoning process. Based on the models of HAT and SAT, but also intentions-based explanations, we expect the post-doctoral fellow to identify levers to foster mutual trust and collaboration within the ATCO-AI team. For this, lab-based experiments will be proposed to identify and characterize design principles and parameters

promoting this collaboration. Finally, these principles will be implemented in an AI assistant, in addition to the goals and workload level identification.

At the end of the project, this Assistant will be tested in operational field experiments by expert users (i.e., air traffic controllers).

Given the time-frame of the project (30 months), the post-doctoral fellow will be involved in a more or less important manner in all the tasks. The international collaborative aspect is essential to the smooth progress of this project; thus, the post-doctoral researcher is required to have sufficient English communication skills. Additionally, scientific communications in international conferences and journal articles are expected throughout the project (e.g., SESAR innovation days, open access publications).

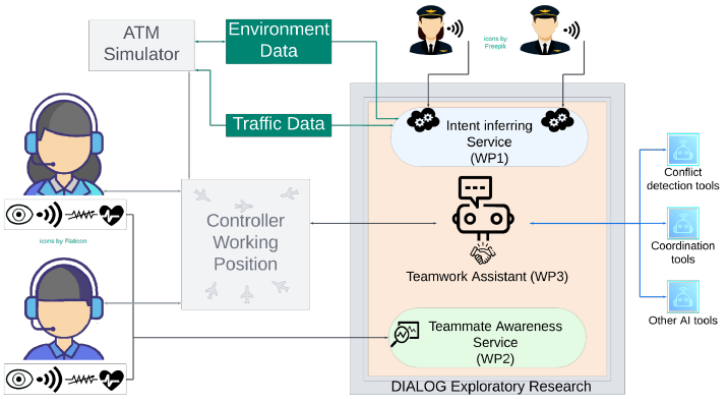


*Figure 1. DIALOG concept*

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**External collaborations**

Mandatory with members of the consortium, especially DSNA (Toulouse) and Radboud University (Netherlands).

**Host laboratory at ONERA**

Department: Information Processing and Systems

Location (ONERA center): Salon de Provence

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