

USER PARTICIPATION IN THE DESIGN OF TRUSTWORTHY HUMAN-AI-COLLABORATION IN AIR-TRAFFIC CONTROL

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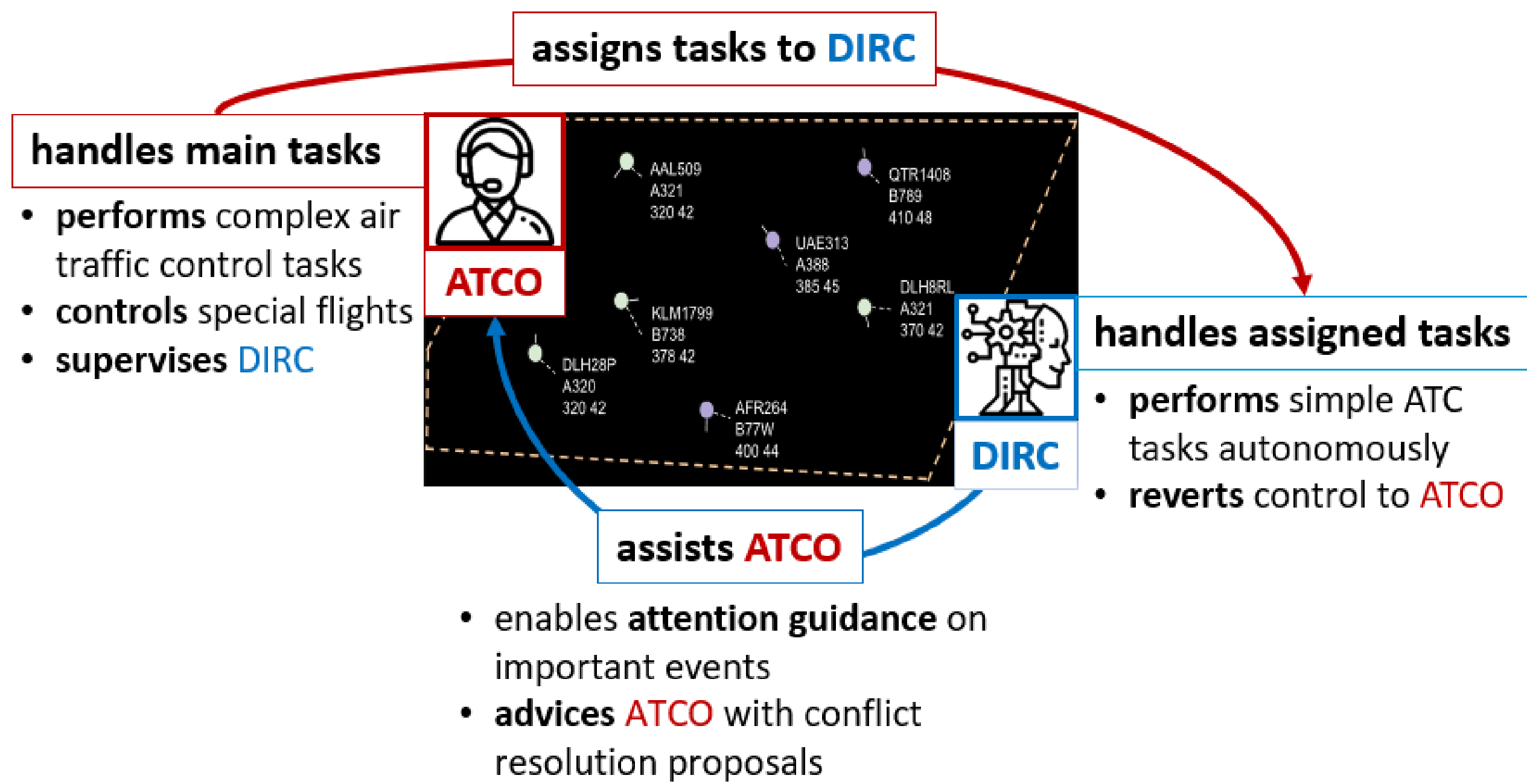


Figure 1: First concept of collaboration between human air traffic controller (ATCO) and digital reliable controller (DIRC)

AI-based Systems in Aviation

The introduction of AI-based systems is one of the core elements in the course of digital transformation in aviation. Human factors expertise is needed to find user-centered approaches of human-AI collaboration.

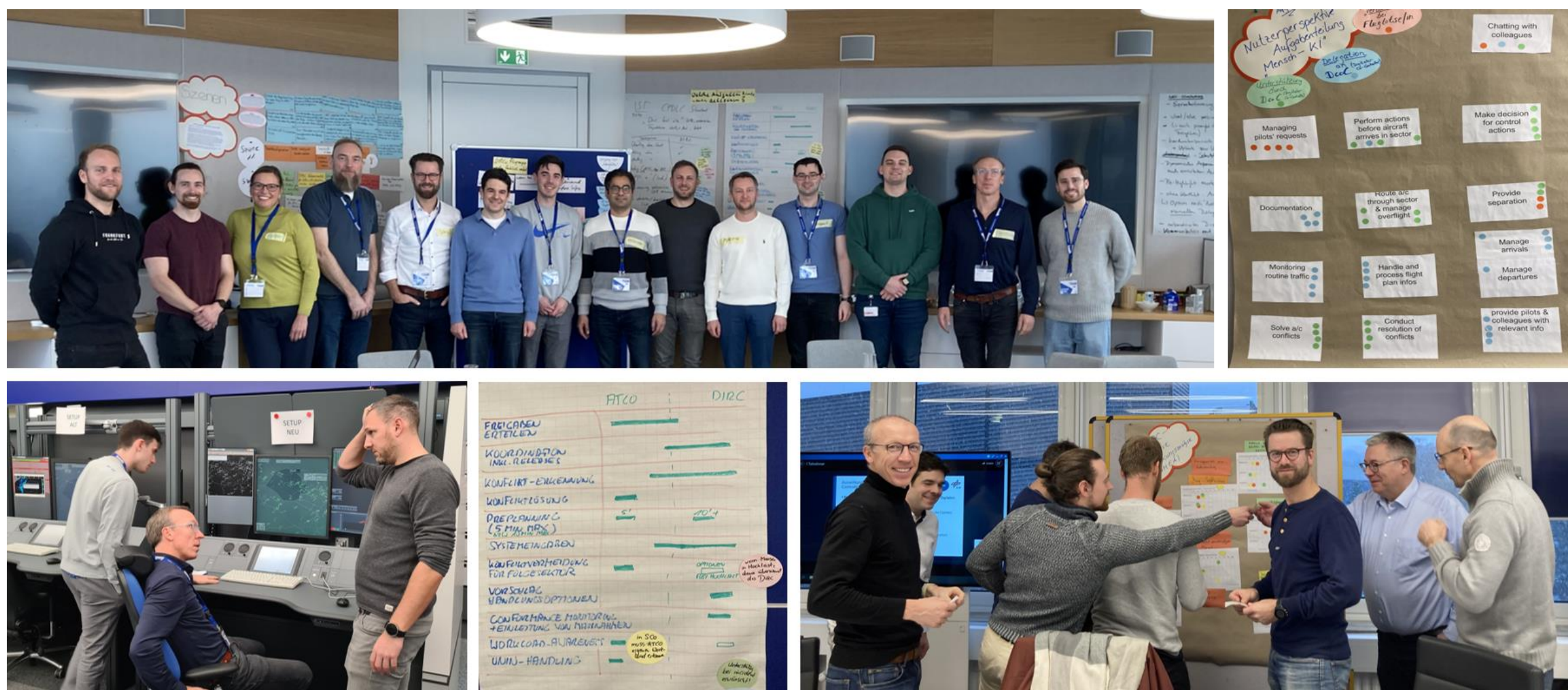
The DLR project “Collaboration of human operators and AI systems” (LOKI) aims at developing iteratively and with the involvement of future users’ concepts, demonstrators and prototypes for trustworthy human-AI collaboration in air traffic control (ATC).

Goals & Method

To consider users’ perspective in early design phases, two workshops with air traffic controllers (ATCO) of Deutsche Flugsicherung GmbH (DFS) and Austro Control GmbH were conducted:

- focus groups & Metaplan-method® were applied
- nine ATCOs participated
- focus on task allocation between human ATCO and digital reliable controller (DIRC)
- understand usage context and perceived change of requirements

Figure 2: Impressions from first workshop in 2022 at DLR in Hamburg and second workshop in 2023 at Austro Control in Wien



First Workshop — User Expectations

Participants would prefer AI based systems for the following purposes:

- reducing cognitive load by assigning redundant task to AI system
- gathering extensive data or data from different sources
- considering ecological factors in flight guidance
- optimal use of airspace via cross-sectoral planning

First Workshop — Task Allocation

n=9 air traffic controller	delegate to DIRC	DIRC assists ATCO	remain by ATCO
Managing pilots’ requests	1	4	4
Documentation	8	1	0
Monitoring routine traffic	6	3	0
Perform actions before a/c arrives in sector	4	5	0
Handle and process flight plan infos	9	0	0
Make decision for control actions	0	5	4
Solve a/c conflicts	0	6	3
Provide separation	0	3	6
Conduct resolution of conflicts	0	5	4
Route a/c & manage overflight	0	7	2
Manage arrivals / Manage departures	7	2	0
Provide pilots / colleagues with info	7	2	0

Second Workshop – Relevant Scenarios

Participants recommended to focus on the following scenarios of collaboration between ATCO and DIRC:

- delegation of flights with simultaneous control of complex traffic
- critical situations, when data link fails
- assistance of ATCO to supervise complex traffic via action probing
- maintain situational awareness of delegated traffic

Conclusions and Further Steps

The workshops were successful in providing insight into ATCOs’ requirements for the division of tasks and responsibilities between humans and AI. Potential challenges for the successful integration of AI systems in aviation were also identified.

These findings will be used in the conceptual design of a DIRC prototype and validation scenarios for ATCO-DIRC collaboration.