Chapter 1

Introduction

The most important task of an air traffic controller (ATCo) is ensuring safety for all involved parties in air traffic. ATCos follow the simple rule “safe, orderly, and expeditious“. Hence, efficiency is the next important aspect mainly having economic thoughts of air navigation service providers (ANSP) in mind.[1]

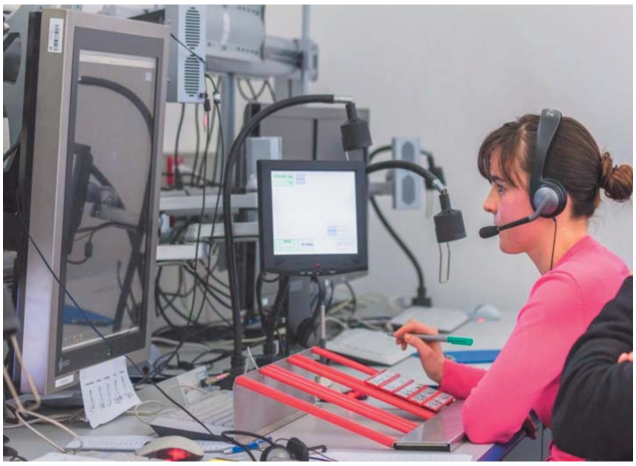

Figure 1.1: Air Traffic Controller using a pen with paper flight strips and a sequencing board

[1] Parts of the following text are taken from [7]

1.1 Problem

Controllers' tasks and their time distribution are one essential factor. ATCos' core tasks consist of communication and coordination with pilots and other controllers. This can be hampered, however, if ATCos need to spend additional time on subordinate tasks such as documentation. One of those subordinate tasks is maintaining flight information in flight strips and on-screen labels. Strips in electronic or paper form contain static and dynamic flight data. Static data comprises e.g., call sign, weight category, destination, or route information. Dynamic data includes e.g., clearances regarding altitude, speed, direction, rates of climb/descent or procedures, as well as special flight situations like emergencies.[2] Paper flight strips are still often used, for example, in high density terminal maneuvering areas (TMA). They have the disadvantage of information not being available or transferable in digital form.

Modern controller working positions (CWP), therefore, offer digital flight strips. However, they normally have to be managed head down averting one's eyes away from the traffic situation display. For both forms of flight strips, manual documentation of flight data is redundant to what the controller already told or will tell to the aircraft pilot.

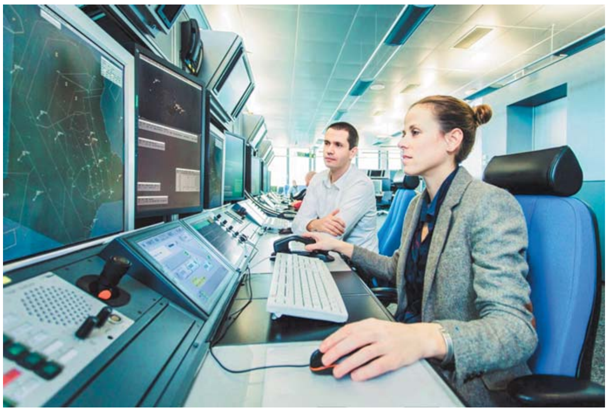

Figure 1.2: Modern Air Traffic Controller Workstation with electronic flight strip integration in the radar label

1.2 Solution

The AcListant® project has shown that Assistant Based Speech Recognition (ABSR) support for ATCos is a solution [5]. ABSR helps the controller with partially automated aircraft radar label maintenance, i.e., an automatic speech recog-

[2]An aircraft is not allowed to change its altitude, speed or flight direction (called heading), without special approval of the ATCo. So the ATCo is the boss. He is responsible for the safety of all aircraft.

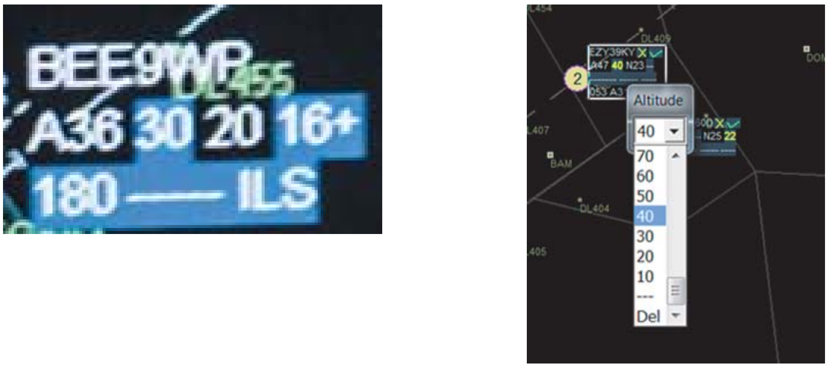

Figure 1.3: Commanded Values Integrated into the Radar Label (left) and menu structure for mouse input of an altitude value (right)

nizer (ASR) uses context knowledge about the current situation from a controller assistant system. This enables prediction of the next most probable commands and reduces the search space for the speech recognizer. With this technique, the AcListant® project achieved command error rates below 1.7% [5]. An ASR system with this level of accuracy is feasible for operational use even in the safety-critical air traffic control (ATC) domain. ATCos need to correct the automation only in very few cases. Hence, ATCos' concentration can remain on their main tasks. Furthermore, less time, spent for subordinate tasks, produces free cognitive resources for increasing air traffic demand.

The AcListant® trials of DLR, Saarland University, DFS, Austro Control, and ANS CR (Air Navigation Service of Czech Republic) have shown that Assistant Based Speech Recognition achieves acceptable recognition rates [5] with very positive feedback from involved controllers [2]. The AcListant®-Strips project [1], the successor of AcListant®, quantifies the benefits of ABSR [6]. Two possible methods to insert given controller commands into the radar labels were compared. The first input method was the baseline. Controllers used the computer mouse for manual input. The second input method automatically worked with ABSR, analyzing the radio communication channel between controller and pilot. The controller may confirm, correct, or reject the output of the speech recognizer. In November and December 2015 the validation trials for benefit quantification were performed in DLR's labs in Braunschweig. The challenge was that the results should not only show a trend, but should be (statistically) significant. The AcListant® -Strips experiments performed for Dusseldorf approach area were repeated between September and November 2022 for Vienna approach. This time it could even be demonstrated that Automatic Speech Recognition and Understanding (ASRU) support reduces the number of missing or wrong label entries. Instead of 12,700 seconds the ATCo spent only 405 seconds of their experiment time for inputting the already spoken information into the radar label cells [3], [4].