Design and Analysis of Virtual Airport Control Tower Systems and Remote Tower Centers

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Session Abstract

Airport ground traffic control is based on visual surveillance by air traffic controllers from the elevated position of a control tower. Decision making such as providing landing or take-off clearance to pilots upon pilot's clearance request via radio communication is based on more or less standardized equipment and procedures utilizing a number of information sources such as flight control strips, approach radar and weather display. On large airports advanced surface movement guidance and control systems (ASMGCS) support controllers with various electronic surveillance systems such as surface movement radar (SME) and multilateration systems so that the relevance of the visual out-of-the windows view may be questioned. Nevertheless work and task analyses still indicate the importance of the visual information for present days controller's work procedures [1][2].

This kind of airport control tower work environment has evolved into a safe and reliable system during the first century of air transportation. However given the present day technological advances it probably no longer is the most efficient and economic way to satisfy the demand for providing cost efficient controlled airspace also to small airports which are increasingly used by low cost carriers.

Since the beginning of the new century research has started in alternatives for the control tower based airport traffic management [3][4][5][6]. One reason is the emergence of high resolution video and visualization technologies, image compression techniques, broad bandwidth data communication, and high power computing with multicore workstations for reasonable cost. This suggests investigation of the possibilities for a new control tower work environment without the need for a costly physical tower building, using a digital video based reconstruction of the far view or synthetic vision. Moreover for ASMGCS equipped large airports it is frequently questioned if visual surveillance via out-of-the windows view is necessary at all, given the full electronic surveillance of the airport.

In this session corresponding research is described aiming at the goal of a Virtual Tower without physical tower building and Remote Airport Traffic Control Center Environments. The Remote Tower Center (RTC) is expected to significantly reduce cost of providing controlled airspace to small airports (usually without any electronic surveillance) by providing a new work environment for surveillance and control of several regional airports from a central remote location.

The contributions to the two Virtual Tower sessions represent several ongoing projects addressing the human factors aspects as well as technological questions of Virtual Tower and Remote Tower Center issues. Advanced technologies such as video-see-through augmentation of the reconstructed out-of-windows view, e.g. by means of weather data and data from electronic non-visual sources superimposed on the digital video panorama is expected to improve the controllers situational awareness, in particular under low visibility conditions[6]. New operational concepts are being investigated which are appropriate for this changing work environment. Experimental testbeds as well as simulation facilities are described which have been set up for this research.

Session 1 includes contributions from the DLR project RAiCe (Remote Airport traffic control Center) and the European Project ART (Advanced Remote Tower) lead by company Saab. Topics are the experimental systems, simulation facilities and results, the relevance of visual cues, and validation results under operational conditions.
Session 2 includes contributions from the German DFS lead project ViCTOR (Virtual Control Tower Research Studies) addressing new concepts, work analysis, communication and safety aspects of the new RTC work environment.

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