3-D Radar Display for Air-Traffic Control Tasks

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Abstract

Air-traffic control tasks are based on an overview of the actual air traffic situation. The major part of this information is transmitted visually by a radar screen. In conventional screen designs the air traffic is displayed from a bird's eye-view in a two-dimensional form. Since the actual areas to be controlled are three-dimensional, the missing dimension on the screen, the altitude, is printed on numeric labels beside the aircraft. Through observation of the radar screen the air-traffic-controller builds a mental model of the actual traffic situation. For this reason, air-traffic-controllers have to spend a considerable part of their mental capacity in transforming the radar screen information. This requires long experience and causes an increase of workload as limiting their tracking capacity. The present paper describes a prototype three-dimensional display for air traffic control.

Introduction

This paper describes the development of a new three-dimensional radar screen. The aim of this new design is to transmit spatial information in a direct way to the air-traffic controllers and thereby to reduce the human information processing demands. Using a CRT with an active polarisation filter in front of the screen and passive polarisation filters in front of the user's eyes, information is presented to the two eyes separately by switching the polarisation direction. The disparity of left and right eye images leads to the perception of object-positions in front of or behind the physical surface on the screen. This technology was used to create a 3D-perception comparable to a natural view. It was not our intent to simulate a natural view completely, but to use the additional dimension to display object interactions in space as they would appear in reality. Therefore a symbol-coded display with different scales in the horizontal and vertical direction was chosen. To enable a precise evaluation of specific situations, the viewpoint and the (virtual) viewing distance can be controlled in all 6 degrees of freedom by a space-ball.

During different presentations, air-traffic controllers expressed the opinion that this new design might lead to improved working conditions. For the future, a comparative evaluation of both conventional and 3-D displays is planned in order to quantify possible improvements of a three-dimensional representation on workload and task performance.